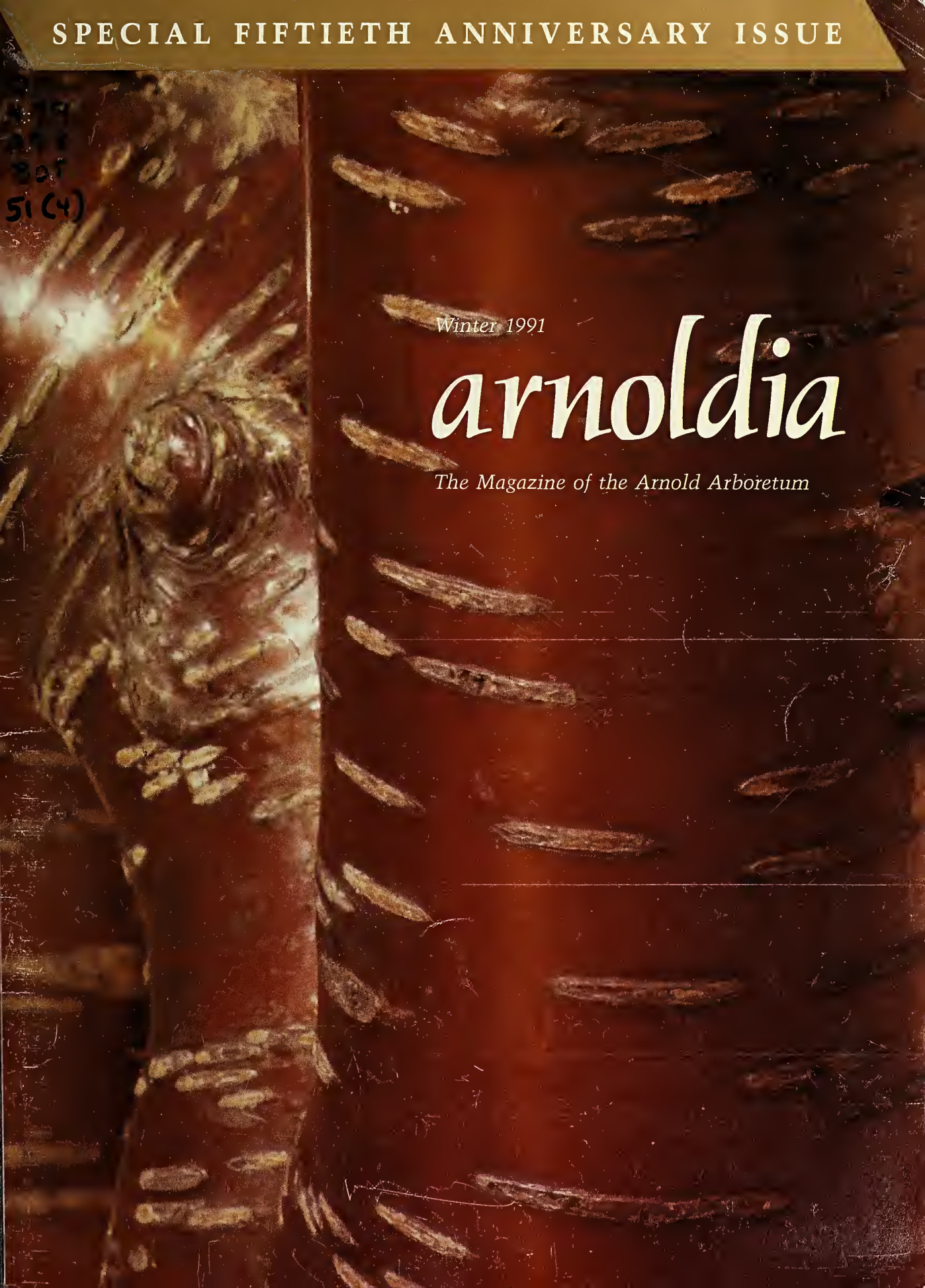
SPECIAL FIFTIETH ANNIVERSARY ISSUE



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Front cover: The beautiful bark of the Amur chokecherry, *Prunus mackia*, introduced into cultivation by the Arnold Arboretum. Photo by Al Bussewitz.

Inside front cover: The foliage of *Metasequoia*. Photo by Ràcz and Debreczy.

Back cover: *Magnolia stellata* and *Magnolia* 'Merrill' greet winter visitors to the Arnold Arboretum. Photo by Al Bussewitz.

Inside back cover: One of the original introductions of *Acer griseum*, the paperbark maple, dug from the wild in Hubei Province, China, in 1909 by E. H. Wilson. Photo by P. Bruns.

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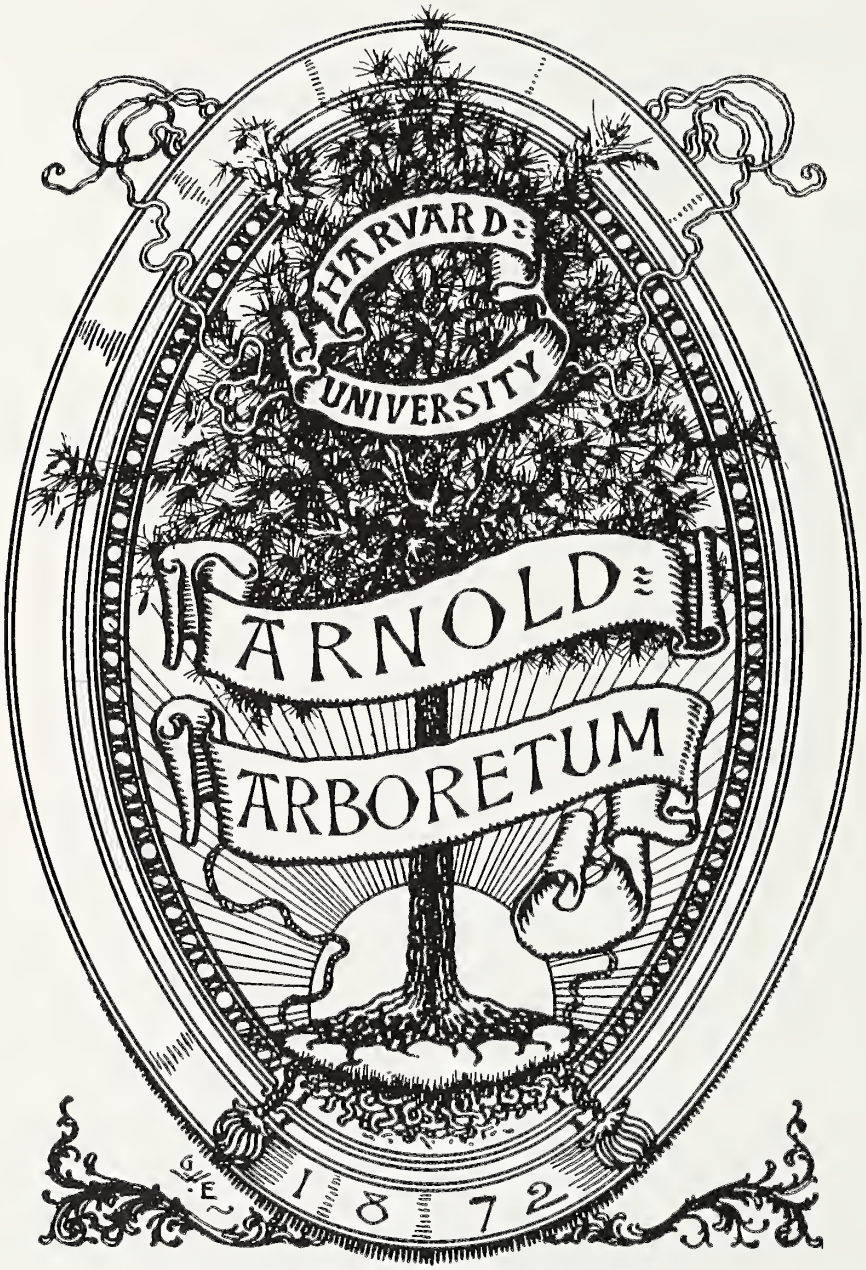
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Introduction

Peter Del Tredici

This special issue of *Arnoldia* commemorates its fiftieth anniversary by reprinting some of the more interesting articles that have appeared in the past. Started in 1941, *Arnoldia* was a continuation of the *Bulletin of Popular Information*, a publication which had been started in 1911 by the Arboretum's first director, C. S. Sargent.

Dr. Donald Wyman was *Arnoldia's* first editor, a position he held for twenty-nine years until his retirement in 1970. Over the course of his tenure, Dr. Wyman wrote an unbelievable 173 articles for the magazine, most of them based on his own observations of plants growing at the Arnold Arboretum in Jamaica Plain and at the Case Estates in Weston. Through his writings in *Arnoldia*, which were subsequently reprinted in his various books, Dr. Wyman had a profound influence on the development of ornamental horticulture in America during the 1950s and 1960s.

What I have tried to do in this collection is to select articles that are not only informative and well written, but also transcend some of the more "trendy" aspects of horticulture and botany. In no way should one consider this selection the "best of" *Arnoldia*. Rather it is a representative sample of the kind of work that has been going on at the Arnold Arboretum for the last half century. In all cases I have tried to pick articles that reflect the eclectic blend of horticulture and botany that has distinguished the work of the Arnold Arboretum from its inception and that will, undoubtedly, continue to do so into the future.

To go back and read through the old *Arnoldias* is to take a trip back through time. One can watch the various trends in maintenance and landscape design come and go. Certain plants become fashionable, until their horticultural Achilles heel is discovered, when they are suddenly dropped. The most interesting thing about reading through the old *Arnoldias* has been finding out that plants that seemed new and wonderful in 1991 were already old hat in 1940. And so, like everything else in life, horticulture seems to move in broad sweeping cycles that repeat slowly over time.

It should be noted that, in the interests of space, all of the articles in this collection have had to undergo some measure of editorial cuts. Without exception these have involved removing either overly technical material or material that has, over time, become out of date. In addition, the extensive bibliographies that make *Arnoldia* articles so useful have been cut. This decision was made in view of the fact that anyone wishing to get more detailed information on one of the subjects covered can always refer to the articles as they originally appeared in *Arnoldia*. It is the editor's hope that this collection not only illustrates the work of the Arboretum over the last fifty years, but also helps to lay a solid foundation for the work of the next fifty.

Portrait of Asa Gray, circa 1865. From the Archives of the Gray Herbarium.

Asa Gray and His Quest for *Shortia galacifolia*

Charles F. Jenkins

C. F. Jenkins of Philadelphia, Pennsylvania, was both an excellent writer and an active horticulturist. He served as editor of *The Farm Journal* for many years, and wrote several books on American history. In 1931, he founded the "Hemlock Arboretum" and published the well-known *Hemlock Arboretum Bulletin* until his death in 1951. In the *Arnoldia* article reprinted here, Jenkins, who was an important supporter of the Arnold Arboretum, tells the intriguing story of Asa Gray and C. S. Sargent searching for the botanical equivalent of the Holy Grail.

The word *bewitched* has antipodal meanings. The first, sinister, fearsome, savoring of Salem trials and clouded minds; the second, charmed, enchanted, captivated. In this second sense Asa Gray was bewitched. For forty years, the greater part of his productive life, the memory of a fragmentary, dried, incomplete specimen in a neglected herbarium cabinet in France haunted him. The assurance of its existence as a living plant and the hope of its rediscovery were with him constantly. A shy, evergreen groundcover with dainty, creamy-white flowers in early spring; cheerful, shiny, bright green leaves in summer; a winter coloring rich and rare—it well deserved his lifelong devotion. When the search was ended and the visible assurance of its existence was placed in Gray's hands, he could well exclaim, as he did: "Now let me sing my *nunc dimittis*."

On November 9, 1838, Gray sailed in the packet ship *Philadelphia* for Europe. He had received appointment to a professorship in the newly planned University of Michigan at Ann Arbor. As the buildings were not ready, he was granted a year's leave of absence, a salary of $1500, and $5000 was placed at his disposal to purchase books for the new University library. The main object of his trip, however, was to examine the original sources of American flora as they existed in the principal herbaria of Europe. After a twenty-one-day voyage he landed in Liverpool and then began a year crowded with rich cultural and educational experiences. Everywhere he made friends among the botanists and scientists and everywhere he found in the old established herbaria specimens of American plants collected through the past century by a long list of botanists and travellers.

Finding the Herbarium Specimen in France

By the middle of March, Gray had reached Paris where he remained nearly a month. Here he worked over the collections of André Michaux (1746–1802), that indefatigable collector and botanist, who fifty years before had spent eleven years in the United States, sending home to France great quantities of botanical treasures. Among these in a cabinet of unidentified plants was a faded, incomplete

Volume 2(3, 4): 18-28, 1946.

specimen with the label: "Hautes montagnes de Carolinie. *An pyrola spec.? An genus novum?*" In his carefully kept Journal, André Michaux not only tells of the finding of the plant, but gives careful directions so that future botanists might also locate it in the "High Mountains of Carolina."

Michaux's Journal in French, as written, is not readily available, nor is there a translation of the whole Journal for English readers. Through the courtesy of Professor Edith Philips, of the French Department of Swarthmore College, the following translation of that small portion relating to the finding of *Shortia* is here presented. It will give some idea of the hardships borne by the botanist in his travels and covers his experiences on four disagreeable winter days when he came upon the little plant which has intrigued botanists for one hundred and fifty-four years.

> The roads became more difficult as we approached the headwaters of the Keowee [spelled Kiwi by Michaux] on the 8th of December, 1788. . . . Two miles before arriving there I recognized the *Magnolia montana* which has been named *M. cordata* or *auriculata* by Bartram. There was in this place a little cabin inhabited by a family of Cherokee Indians. We stopped there to camp and I ran off to make some investigations. **I gathered a new low woody plant with saw-toothed leaves creeping on the mountain at a short distance from the river.** [Michaux here refers to *Shortia*.] The weather changed and it rained all night. Although we were in the shelter of a great Strobus pine our clothing and our covers were soaked. About the middle of the night I went to the cabin of the Indians, which could scarcely hold the family composed of eight persons, men and women. There were besides six big dogs who added to the filth of this apartment and to its inconveniences. The fire was placed in the middle without any opening in the top of the cabin to let the smoke out; there were plenty of holes, however, to let the rain through the roof of this house. An Indian came to take my place by the fire and offered me his bed which was a bear's skin. But finally the rain having stopped and annoyed by the dogs which kept biting each other continually to keep their place by the fire, I returned to the camp.
>
> This place which is called the source of the Keowee is incorrectly so indicated. It is the junction of two other rivers or large torrents which unite at this place and which is known only as the forks of the Keowee.
>
> On December 11 it froze hard and the air was clear and keen. I noted a chain of high mountains which extended from west to east and where the frost was little felt in places exposed to the sun. I gathered a *Juniperus* [*repens*] which I had not yet seen in the southern part of the United States but it must be noted that I saw on these mountains several trees of the northern regions such as *Betula nigra, Cornus alternifolia, Pinus strobus, Abies*, Spruce, etc. We crossed a space of about three miles in the midst of *Rhododendron maximum*. I came back to camp with my guide at the head of the Keowee and gathered a large quantity of the low woody plants with the saw-toothed leaves that I found the day I arrived. I did not see it on any other mountain. The Indians of the place told me that the leaves had a good taste when chewed and the odor was agreeable when they were crushed, which I found to be the case.
>
> [Michaux's directions for finding *Shortia*]
>
> The head of the Keowee is the junction of two torrents of considerable size which flow in cascades from the high mountains. This junction takes place in a small plain where there was once a Cherokee village. On descending from the junction of these two torrents with the river to one's left and the mountains which face north on the right, one finds at about 200-300 feet from the junction, a path formed by the Indian hunters. It leads to a brook where one recognizes the site of an Indian village by the peach trees which still exist in the midst of the underbrush. Continuing on this path one soon reaches the mountains and one finds this plant which covers the ground along with the *Epigaea repens*.

In his journal for April 8, 1839, Gray records the find in the herbarium of the Paris Museum which immediately aroused his interest:

"But I have something better than all this to tell you. I have discovered a new genus in Michaux's herbarium—at the end, among *plantae ignotae*. It is from that great unknown region, the high mountains of North Carolina. We have the fruit, with the persistent calyx and style, but no flowers, and a guess that I made about its affinities has been amply borne out on examination by Decaisne and myself. It is allied to *Galax*, but is 'un très distinct genus,' having axillary one-flowered scapes (the flower large and a style that of a *Pyrola*, long and declined). Indeed I hope it

C. E. Faxon's drawing of Shortia galacifolia, *first published in* Garden and Forest *in 1888. From the Archives of the Arnold Arboretum.*

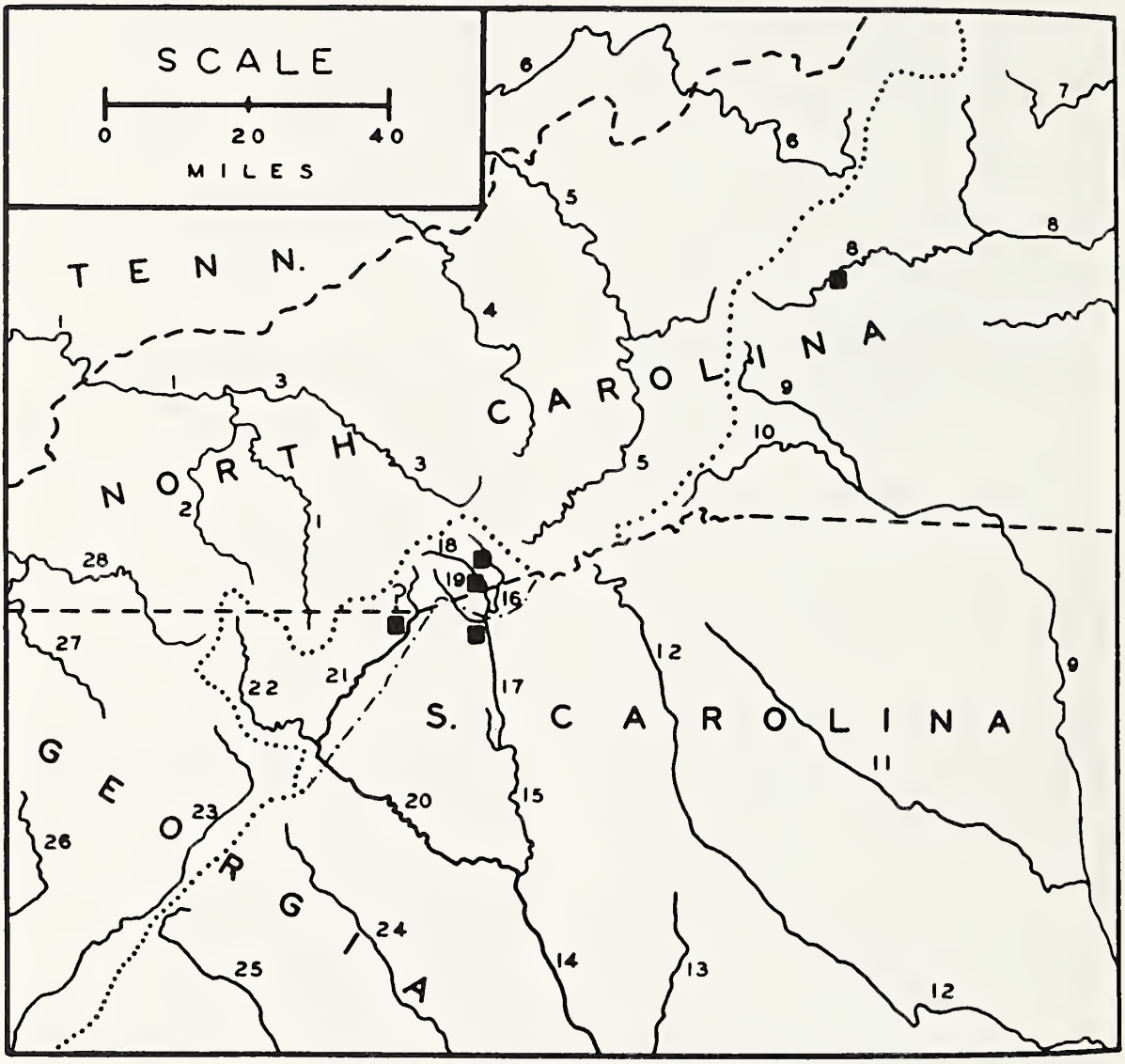
will settle the riddle about the family of *Galax*, and prove Richard to be right when he says *Ordo Ericarum*. I claim the right of a discoverer to affix the name. So I say, as this is a good North American genus and comes from near Kentucky, it shall be christened *Shortia*, to which we will stand as godfathers. So *Shortia galacifolia*, Torr. and Gr., it shall be. I beg you to inform Dr. Short, and to say that we will lay upon him no greater penalty than this necessary thing—that he make a pilgrimage to the mountains of Carolina this coming summer and procure the flowers."

Charles Wilkins Short (1794–1863) and Asa Gray never met. Their friendship was founded on a voluminous correspondence and a mutual respect for the botanical writings and attainments of each other. Both had been graduated in medicine and both were college instructors in science. Short was Gray's senior by sixteen years. He never saw the dainty little plant so honorably named, nor the dried specimen in the Paris herbarium. This and the few lines in Torrey and Gray's *Flora of North America* were all that were definitely known of it until fourteen years after Dr. Short's death. Apparently the latter never made the penalty pilgrimage to the mountains of Carolina in search of his namesake. His own large collection of dried plants passed to the Academy of Natural Sciences in Philadelphia, but his name is still to be found on the twenty-five thousand herbarium specimens he is said to have generously distributed to like-minded enthusiasts throughout the world.

The Search of the Carolina Mountains

Returning from his trip abroad, Gray reached home early in November, 1839, and immediately plunged into the task of completing the *Flora of North America*. *Shortia*, however, was always in his mind. It was Michaux's incomplete and misleading label "Hautes montagnes de Carolinie" on the herbarium specimen in Paris that delayed for nearly forty years the satisfaction he was to have in holding in his hand a living plant. In anticipation of a botanizing trip Dr. Gray now consulted Michaux's journal. But one must read carefully to find the reference, although in all the journal no species location is so faithfully described as that of *Shortia*, but Gray unfortunately missed the significance of Michaux's directions, or did not realize that the passage reproduced above appertained to the much desired *Shortia*. With two friends, John Carey and James Constable, he started on his first quest late in June, 1841. To the "High Mountains" they went, Roan, Iron, Grandfather, Black, and others, all over 5000 feet in height. Michaux had also visited them. He recorded in his journal that on the 30th of August, 1794, standing on the summit of Grandfather, which he thought was the highest peak in all the Appalachians, he and his guide, John Davenport, had chanted the Marseillaise and cried "Vive l'Amèrique et la Republique Francaise, Vive la Liberté!"

The Gray exploring party made its headquarters in the little town of Jefferson, the county seat of Ashe County, North Carolina. None of the party knew that *Shortia* flowered



A map showing the limited distribution of Shortia *in the southern Appalachian mountains, as known in 1950. Since that time some new populations have been located, but others have been destroyed as a result of flooding associated with reservoir construction. Reprinted from* Rhodora, *volume 52, 1950.*

in late March or early April, nor did they know at what altitude it grew. Reporting on his extended trip in a classical account which he wrote for Sir William J. Hooker, Gray says: "We were unsuccessful in our search for a remarkable undescribed plant with a habit of *Pyrola* and the foliage of *Galax*, which was obtained in the high mountains of Carolina. The only specimen extant is among the 'Plantae incognitae' of the Michauxian herbarium, in fruit only; and we were anxious to obtain flowering specimens, that we might complete its history; as I have long wished to dedicate the plant to Professor Short, of Kentucky,

whose attainments and eminent services to North American botany are well known and appreciated both at home and abroad." In a footnote from this quoted passage is the first published description of the genus *Shortia* Torrey and Gray.

Two years passed and the position at Michigan having been abandoned, on April 30, 1842, Gray was appointed to the Fisher Professorship of Natural History at Harvard College. Again *Shortia* called him and for nearly three months in 1843, this time with another friend, William S. Sullivant, he herborized in the same general territory, the happy hunting ground of many distinguished botanists, both before and since. But again he was searching in the wrong place and again was disappointed. In neither trip did he come within many miles of where the little plant had been first discovered.

Dr. John Torrey was the first to suggest, as early as 1852, that *Shortia* was probably an early spring plant and further that it might disappear after flowering and perfecting its seed. "One should be pretty early on the ground to find it in flower," he wrote Dr. Short who was anticipating a journey to the Carolina mountains in quest of it. John Carey about the same time was urging Dr. Short to ascertain the name and whereabouts of Michaux's old guide, John Davenport, from whom he might learn his track "in general if not in particular."

Rediscovery at Last!

It was in May, 1877, that seventeen-year-old George McQueen Hyams (1861–1932) of Statesville, N.C., found *Shortia* growing on the banks of the Catawba River near Marion, the county seat of McDowell County, N.C., some seventy miles in a direct line from the site of Michaux's discovery. His father, M. E. Hyams (1819–1891), was an herbalist but did not know the plant and eighteen months later sent a specimen for identification to a friend, Joseph W. Congdon of East Greenwich, R.I. He in turn wrote Dr. Gray telling him he thought he had *Shortia*. The latter wrote "Send it on" and at last the search of nearly forty years was at an end. Dr. Gray was triumphant. "No other botanist has the news," he hastened to write, on October 21, 1878, to his close friend and fellow botanist William M. Canby, who was to be the first to share with him the jubilation over the rediscovery. In the period of forty years of waiting, many deserved honors had come to him, including college degrees and memberships in fifty learned and cultural societies throughout the world. A few months previously he had been elected a member of the Academie des Sciences of the Institut de France, one of the most coveted rewards to a scientific man. Yet the discovery he was communicating to his friend, "has given me," he said, "a hundred times the satisfaction that the election to the Institut did." And then he continues: "If you will come here I can show you what will delight your eyes and cure you effectively of the skeptical spirit you used to have about *Shortia galacifolia*. It is before me with corolla and all from North Carolina! Think of that! My long faith rewarded at last."

Dr. Gray wrote to M. E. Hyams, October 27, 1878, telling him how much immortality had been lost for his son by not sending the specimen when it was found eighteen months before, in order that the description might have been included in the edition of the Flora which had gone to press in the meantime, but promising to make his name famous through an article in "Silliman's Journal pro tem." He also informed M. E. Hyams that he or Mr. Canby, or both, would be down the following May, call for the boy, and ask to be taken to the spot. Mr. Hyams in replying, October 31, tells of the finding of the plants: "We were passing along the road and my attention was called to an elevated hillside that I could not ascend as being at the time rather exhausted, being sixty years old, requested him [his son] to ascend and bring whatever was in flower. I have forgotten the locality, but he is fully known to it, as he lived within two miles of the place for several years."

Now that a definite station for *Shortia* had been located, Dr. Gray early in the spring of

1879 organized a real excursion to see it growing in the wild. Mrs. Gray and her brother with the latter's wife and their two daughters and his botanical friends, William M. Canby of Wilmington, Del., Dr. Charles S. Sargent of Brookline, Mass., and J. H. Redfield of Philadelphia, Penna., composed the party. The four principals of the party arrived in Statesville, N.C., by train and were entertained by a Mr. Wallace, a leading citizen of the town. Redfield wrote a full account of the trip but only that portion relating to *Shortia* is included here. He says: "The recent rediscovery of *Shortia* in North Carolina has created much interest among botanists. . . . Searches repeated in the course of many years had proved fruitless, so that to the botanical fraternity and particularly to the author of the genus the recovery was somewhat like that of a long lost child. . . . The object was not only to see *Shortia* but to find more of it if possible and to explore some portions of the mountains which the oldest member of the party [Dr. Gray] had visited in 1841 and 1843. . . .

"A visit to the root and herb warehouse belonging to Wallace Brothers and under the charge of Mr. Hyams, furnished evidence that this branch of industry has reached an extent and importance of which few are aware. The printed catalogue of indigenous plants, dealt in by this house, enumerates about 630 species. . . . These simples find a large market, both in this country and Europe, and the orders come mainly from the wholesale druggists and the manufacturers of patent medicines. Think of a single order for fifteen tons of *Hepatica triloba*! . . .

"Being now in McDowell County, the *Shortia* locality was visited under the guidance of Mr. George M. Hyams, the actual discoverer. In the secluded and well-protected station, well overshadowed by Rhododendrons and Magnolias, was seen the little colony of the plant, so long sought and by many so long doubted. Its companions were *Mitchella repens, Asarum virginicum* and *Galax aphylla*. The space over which the plant extended was perhaps 10 feet by 30 and in all there may have been 50 to 100 plants. As the plant multiplies by stolons it is remarkable that its area should be thus restricted and since in the struggle for life of two allied plants the weaker 'must go,' Dr. Gray suggested the possibility that its stronger cousin, the *Galax*, had crowded out the *Shortia*. And here indeed, in what may be the last foothold of the rarity, *Galax* appeared to be actually doing so. Yet the plants, though comparatively few, were vigorous and healthy. Other stations may be looked for; but they must be hard to find. When we consider the long search which has been made for this plant, how all the mountain region of the Carolinas and Tennessee has been examined by the sharp optics of Buckley, Rugel, M. A. Curtis, Dr. Gray, Canby, Le Roy and Ruger, the Vaseys, elder and younger, Chickering and others, it is very certain that if there be other localities they must be 'few and far between.' " . . .

Dr. Sargent Finds Shortia

Dr. Sargent was not satisfied with the meager results of the search for *Shortia* in 1879 and again visited the Carolinas in the early autumn of 1886 hunting for *Magnolia cordata*, mentioned by Michaux. At Sapphire, Transylvania County, N.C., he and Mr. Stiles, who accompanied him, were met by Frank E. Boynton of Highlands. One evening after a botanizing trip Dr. Sargent produced a leaf and asked what it was. Mr. Boynton thought it might be *Galax* but examining it more closely said he did not know. Mr. Stiles jokingly said: "That is *Shortia*," and it turned out so to be. It was a coincidence that in the evening mail the following letter arrived from Dr. Gray:

September 17, 1886

My dear Sargent:

Would I were with you. I can only say crown yourself with glory by discovering a habitat—the original habitat of *Shortia* which we will believe Michaux found near where *Magnolia cordata* came from in that first expedition.

Yours, ever,
Asa Gray

Unfortunately Dr. Sargent could not recall where he had found the *Shortia* leaf. He and his party had travelled all day over rough mountain country searching for *Magnolia cordata*. So the two Boynton brothers were sent back to locate the growing plants from which the leaf had been plucked. Frank Boynton remembered that Dr. Sargent and he had passed through Bear Camp, a small settlement on Bear Camp Creek, a little stream flowing into the Horse Pasture River, which in turn enters the Keowee. Here they found *Shortia* and gathered a small amount, and it was one of these living plants which Dr. Sargent placed in Dr. Gray's hands as coming from the Michaux land, "the headwaters of the Keowee," for it was at this place that Michaux first found it on December 8, 1788. . . .

As has been stated, up to the time of the rediscovery of *Shortia* Dr. Gray had received fifty honorary degrees and memberships in learned societies. Twenty-one more were to come to him before his death, which occurred January 30, 1888. He was buried in Mount Auburn Cemetery, Cambridge, Mass., where a simple stone bearing a cross marks his last resting place. It may not be too late to suggest that, with the soil properly prepared, there might be planted on his grave an ever green and ever beautiful blanket of the little flower which he so loved and which he pronounced "perhaps the most interesting plant in North America."

A drawing of the type tree of Metasequoia glyptostroboides *growing at Modaoqi village. This illustration, provided through the courtesy of Dr. H. H. Hu, is from the Archives of the Arnold Arboretum.*

Metasequoia, Another "Living Fossil"

E. D. Merrill

For a modern-day equivalent of the *Shortia* story, we have the case of the dawn redwood. The tale of its discovery is here told by Elmer D. Merrill, who was director of the Arnold Arboretum from 1935 to 1946. He will always be remembered for arranging the first introduction and distribution of dawn redwood seeds from the wilds of Hubei Province, China.

Ginkgo biloba, a monotypic genus of very ancient lineage, in fact from the standpoint of geologic history, outside of the Cycadaceae, the most ancient of living trees, is often spoken of as a "living fossil." The sole species, once of very wide geographic distribution in the North Temperate Zone, can scarcely be distinguished from fossil forms of ancient Mesozoic times. This is a beautiful example of the persistence of selected life forms, in highly organized groups, through many millions of years. *Ginkgo* has persisted in cultivation in China, but there are a few places in that country where it is spontaneous in limited forested areas. Whether or not it is truly native in such places, or merely occurs as a descendant from planted trees, is not definitely known. It was introduced into Japan about A.D. 700, into Europe about 1730, and into the United States in 1784. Now another striking case develops, not quite as old geologically as is the *Ginkgo*, through a remarkable discovery originally made by Mr. T. Wang in 1945. *Metasequoia*, previously known only from paleobotanical records, is now shown to exist in the form of a single living species in a very limited area, and it, or its immediate ancestry, goes back to Mesozoic times. . . .

Volume 8(1): 1-8, 1948.

Mr. Wang's fragmentary specimens of 1945 were supplemented by additional material collected in the following year, originally three large trees representing this strange conifer having been located in northeastern Szechuan, very close to the Hupeh border. With the additional collections made in 1946, the discovery then developed into one of extraordinary interest in that the tree proved to be a living species of a genus, *Metasequoia*, which, up to that time, had been known only from paleobotanical records. Various species of North America and Asia originally ascribed to the genus *Sequoia* as fossil forms, proved not to belong in that genus, and in 1941 the new genus *Metasequoia* was proposed to accommodate these; and only four years after that genus was described, a living species was actually found in China. This, because of the ancient lineage of *Metasequoia*, and its former wide geographic distribution (various parts of North America, Japan, Saghalien, Manchuria), is a most extraordinary circumstance. The proposed paleobotanical species are *Metasequoia heerii* from North America, *M. japonica* and *M. disticha* from Japan, and *M. chinensis* from Manchuria and Saghalien. Assuming that all of these extinct species are actually congeneric, then, in former geologic times, *Metasequoia* was a genus of very wide

One of the Metasequoia *seedlings raised from the original batch of seeds collected by C. J. Hsueh in China in 1947 (AA #528-48). The young girl is pointing to where the growth of the tree started in spring 1951. The photograph was taken in September 1951. From the Archives of the Arnold Arboretum.*

geographic distribution, as was *Ginkgo*. The latter is represented by only a single living species and this apparently now persisting only because it was preserved in cultivation in China. And now this striking *Metasequoia* is found, confined to a relatively few individual trees scattered along small streams and on the slopes of northeastern Szechuan and the adjacent parts of Hupeh.

It is sufficiently extraordinary, only four years after *Metasequoia* was actually described from the fossil records, that a living species of the genus should be found in China; but what is perhaps even more extraordinary is that when found, this living species, the sole surviving representative of a former widely distributed genus, was apparently not far from the verge of extinction as a living entity in its native habitat.

As noted above, the first observer located only three trees. A second expedition was sent out by Professor Wan-Chun Cheng of the National Central University, Nanking, in 1946, and Mr. C. J. Hsueh, his assistant, who led this expedition, brought the census up to about 25 trees. When botanical specimens were received at the Arnold Arboretum in the latter part of 1946, I immediately became interested in the possibility of securing seeds of this extraordinary species, and accordingly communicated with Dr. H. H. Hu, Director of the Fan Memorial Institute of Biology in Peiping, one of the joint authors concerned with the actual description of the species. Incidentally, Dr. H. H. Hu was trained at the Arnold Arboretum, receiving his Sc.D. degree from Harvard University in 1925. Dr. Hu responded favorably and accordingly a modest grant was made from the Arnold Arboretum restricted Chinese exploration fund provided by the late Harrison W. Smith of Tahiti, himself a graduate of Harvard in 1895 and long interested in matters Chinese. On the basis of this grant Professor Cheng organized a third expedition to the type locality, this also led by his assistant Mr. Hsueh. He flew from Nanking to Chungking on September 3, 1947, and arrived at Mou-tao-chi, 110 kilometers east of Wan-hsien, Szechuan, on September 11, where the type of the species was originally discovered. This is very close to the Hupeh border. He spent approximately three months prosecuting field work in this part of Szechuan and in adjacent parts of Hupeh. He reports somewhat more than one hundred large trees representing the species, occurring on slopes, along small streams, and near rice paddies (some of the trees planted) between the altitudes of 900 and 1300 meters scattered over an area of about 800 square kilometers. This is a region of considerable rainfall, with some ice and snow in the winter months. The center of its greatest abundance is in the Shui-

One of the original Metasequoia *seedlings in all its glory at the Arnold Arboretum. Photographed in 1990 by Ràcz and Debreczy.*

sa-pa valley in Hupeh Province, where there are at least 1000 of the trees, including the small ones; but there are no groves or forests made up of the species. In other places, such as Houng-pin-ying and Mou-tao-chi, there are only a very few trees. It is of interest to note that the valley where most of the trees are now found takes its name from that of the tree, the tree itself known as *shui-sa* (*shui* = water, *sa* = fir or spruce), the place of its greatest occurrence being Shui-sa-pa.

The largest tree which was measured was 35 meters high, its trunk 2.3 meters in diameter. While 1947 was reported as not being a good seed year, an ample supply of seeds was secured during the time that Mr. Hsueh was in the field. These were delivered in Nanking early in December; the first small sending reached Boston January 5, 1948, and a second and larger shipment is now in transit. Seeds were planted in our propagating house early in January, and many of these germinated before the end of the month. Thus it is that in due time the Arnold Arboretum will have a certain number of living plants for distribution.

Following long established Arnold Arboretum practice, packets of seeds have been widely distributed to institutions in the United States and Europe. It is, of course, not known whether this remarkable species will prove to be hardy under the rather difficult climatic conditions characteristic of the Boston area. With excellent germination records it is now certain that we shall be able to establish this ancient but now nearly extinct type in various parts of the United States and elsewhere, for somewhere, with us, favorable climatic conditions will be found—if not in the northeast, then in the south or on the west coast. The point is emphasized that in spite of the present unfavorable economic conditions, in spite of adversities in China rendering travel difficult, and in spite of unfavorable exchange conditions, this cooperative project did succeed; that as a result an ample supply of seeds is available; that the seeds are viable; and, this being the case, the Arnold Arboretum has made an important contribution, working through its Chinese associates, in thus being involved in an attempt to preserve a remarkable conifer, and a species that in its native habitat is apparently not far from the verge of extinction. Incidentally, Professor Cheng who, with Dr. Hu, cooperated with us, writes that without the modest grant made by the Arnold Arboretum, it would have been impossible for his representative to make the trip to Szechuan and Hupeh in 1947, and comments on the fact that trees are being rapidly destroyed by cutting in this region as well as in various other parts of China. He specifically mentioned *Picea heterolepsis* Rehder & Wilson, which was described in 1914 from collections made by E. H. Wilson for the Arnold Arboretum in western Szechuan in 1910, and a species now growing in our grounds. Not a

single tree can now be found in the type locality, nor have the Chinese botanists been able to locate the species anywhere since 1932. The actual grant made by the Arnold Arboretum to finance this trip to Szechuan in 1947 was only $250 which, because of the extreme inflation, actually yielded $9,750,000 in Chinese currency. This will give some idea of the current financial difficulties under which the Chinese botanists are carrying on their work.

This new "living fossil" is a large tree, attaining a height of at least 115 feet, with a trunk diameter of at least 7.5 feet. One of its striking characteristics is that, like the various species of *Larix* (larch) and *Pseudolarix* (golden larch), and our *Taxodium* (swamp cypress), its leaves are deciduous, the trees being leafless in the winter months. In general appearance the leafy branchlets suggest those of the genus *Glyptostrobus*. It is needless to repeat here the technical characters of this remarkable species, as these will be available when the formal description is published. All I have attempted to do has been to give the highlights regarding this remarkable discovery, and to call attention to the fact that viable seeds of the species have been received, from which young plants are now being grown.

It has been argued in some quarters that we approach the condition of diminishing returns in the botanical exploration of China, a field that has long been one in which the Arnold Arboretum has specialized. This statement is doubtless true to a certain degree, but from what has appeared in extensive collections made within the past three decades, I am still of the opinion that a vast amount of field work is still called for and is still justified. This remarkable *Metasequoia* find bears out this belief. In spite of all that has been published on the enormously rich flora of China in the past century, and particularly within the past four or five decades, there are vast areas still remaining to be explored, and the already known flora will be very greatly increased, as to the number of actually known species, when the more recently assembled collections are studied in detail.

Reminiscences of Collecting the Type Specimens of *Metasequoia glyptostroboides*

Hsueh Chi-ju

It was by complete chance that Dr. Peter Ashton, then Director of the Arboretum, happened to meet Professor Hsueh in Kunming, China, in 1984. The following article, which is an outgrowth of that meeting, is unusual on several accounts. In the first place, American audiences seldom get to hear about Chinese plants from Chinese botanists. And second, it puts Professor Hsueh's early work with *Metasequoia* in a very personal light.

Forty years ago, I happened to see the specimen of *Metasequoia glyptostroboides* that Mr. Wang Zhang had collected at Modaoqi (which means, literally, knife-grinding) village in Wanxian county, China. The next year, following the route Mr. Wang had taken, I made two trips there to collect perfect specimens and to conduct further investigations. Although I am old now, the two trips are still fresh in my memory.

I graduated from the Forestry Department of the former National Central University at Zhongjing (Chungking) in 1945 and then worked on the gymnosperms, studying for a master's degree under the guidance of Professor Cheng Wanjun. One day in 1945, Wang Zhang, who worked at the Central Forestry Experimental Institution, sent a cone-bearing specimen collected at Modaoqi to Professor Cheng for identification. Its vernacular name was *shui-shan* (water fir), and it was somewhat similar to *Glyptostrobus pensilis* (*G. lineatus*). After making a preliminary identification, Professor Cheng considered that it might belong to a new taxon of the Gymnospermae, since the opposite arrangement of the leaves and cone scales differed from that of *G. pensilis* and other members of the Taxodiaceae.

Since the specimen Mr. Wang collected had no male inflorescences and since the cones had been picked up from the ground, we didn't know how the cones grew on the branches. In addition, we had no information on whether it was deciduous or evergreen, on its flowering season, or on its ecological characteristics and distribution.

Further research being necessary, Professor Cheng naturally advised me to collect some perfect specimens and to make an investigation. Since we had no funds and everybody was quite hard up, I could only go to the place on my own, carrying a few pieces of simple baggage and specimen-clips. I left Chungking city by steamboat and, after two days, arrived at Wanxian county, on the northern bank of the Changjiang (Yangtze) River. After crossing the river, I had to walk 120 kilometers [72 miles] to my destination. In 1946 I made two trips from Chungking to Modaoqi, in February and May, respectively, both times singlehandedly.

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Professor Hsueh Chi-ju, who collected not only the type specimens of Metasequoia, *but also the seeds that were sent to the Arnold Arboretum for distribution worldwide. Photographed in 1984 by P. S. Ashton.*

The First Trip to Modaoqi

I remember that on my first trip the boat was moored in Fengdu county for the first night. On a hill behind the county town was a temple regarded in the Old China as an inferno where the "Lord of Hell" reigned. Dead souls were supposed to go there to register. So I made use of this rare opportunity to take a solitary night walk in this weird and dreadful place—evidence that I was full of vigor and curiosity in my youth.

At that time there was no highway from Wanxian county to Modaoqi village. My trip was very difficult, the trails threading through the mountains being less than one foot wide. The region was inhabited by the Tu minority and had been isolated from the outside world for ages. During the war of resistance against Japan, the Hubei provincial government moved to Enshi county in its neighborhood; thenceforward its intercourse with the outside world had somewhat increased. Since this region was located on the border between Sichuan and Hubei provinces, an area characterized by difficult and hazardous roads, murder and robbery occurred frequently. It was regarded as a forbidding place and was seldom visited by travellers.

On my trip, I set out from Wanxian and stayed at Changtanjing for the night. My fellow travellers were several peddlers. While we chatted around a fire at night, the innkeeper came to give us a warning: "If you go any farther you will travel along a narrow valley cut by the Modaoqi River. Travel will become more dangerous and threatened with robbery, which often occurs at dangerous turns of the river. Travellers from both directions are robbed by being jammed together, or 'rounded up.' Therefore, if you see no travellers coming your way for a long time, it is very likely that a robbery has occurred ahead, and you had better take care. Only a few days ago we witnessed such an incident in this vicinity." The innkeeper then gave a vivid and horrible description of a murder. The poor peddlers, my fellow travellers, were very frightened. They dared not go any farther and returned to Wanxian the next morning. As for me, I was bent on finding that colossal tree and collecting more specimens, so I resolutely continued my trip along the route marked out by Mr. Wang, without any fear or hesitation.

Finally, at dusk on the third day, I reached my destination safely. I set out immediately to search for that colossal tree despite hunger, thirst, and fatigue, and without considering where I would take my lodging. It was February 19th, and cold. The tree was located at the edge of the southern end of a small street. In the twilight nothing was discernible except the withered and yellowed appearance of the whole tree. My excitement cooled.

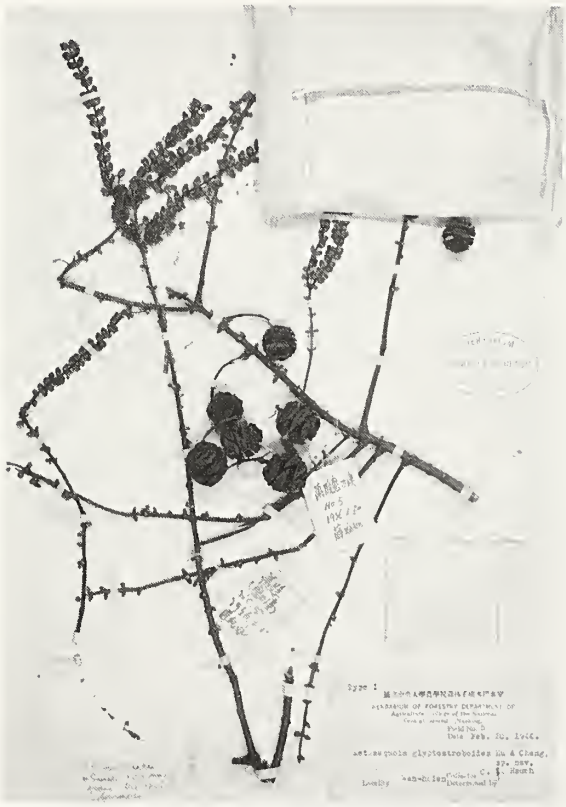
"Am I to bring back just some dried branches?" I asked myself.

The tree was gigantic; no one could have climbed it. As I had no specific tools, I could only throw stones at it. When the branches fell from the tree, I found, to my great surprise, that there were many yellow male cones and some female cones on the leafless branches. I jumped with joy and excitement. The weather being cold, many plants were not yet in flower. Since I was short of money, I returned to Chungking city three days later.

The Second Trip to Modaoqi

The second trip was in May of the same year, its purpose being to collect the cone-bearing specimens in addition to ascertaining the natural distribution of *Metasequoia* and the flora of the region. On my way to Modaoqi, about half a day's walk from my destination, I came across a peasant carrying a bundle of fagot mixed with some *Podocarpus nagi*. The wood was said to have been cut from a nearby mountain. I took two twigs and pressed them as specimens. This indicated that *P. nagi*, another primeval gymnosperm, occurred in the vicinity.

This time I took measurements of the *Metasequoia* tree. It was 37 meters (about 122 feet) high and 7 meters (about 23 feet) in girth, and still grew vigorously.



One of the many herbarium specimens of Metasequoia *that Professor Hsueh collected during his first trip to Modaoqi. This specimen is in the Herbarium of the Arnold Arboretum. Photo by D. E. Boufford.*

To ascertain the distribution of *Metasequoia*, I interviewed many local people, but none of them knew. The innkeeper did tell me that a whole stretch of *shui-shan* trees might be found at Xiahoe, in Lichuan county, Hubei province, about 50 kilometers (30 miles) away. As I had almost exhausted my travelling allowance, and as communication was extremely inconvenient, I had to give up my attempt to extend my trip to that place. Nevertheless, the innkeeper had provided an important clue for a more thoroughgoing exploration later. All I could do was—taking the original spot as a center—to make a reconnaissance within the area I could cover in one day. In a few days I had collected more than one hundred specimens.

Two things impressed me deeply. One was that I came across whole stretches of *Geastrum* sp. (an earthstar fungus) mixed with small stones of a similar shape, forming a peculiar landscape. The other thing that impressed me was an incident. Not even by the day before my departure had I given up on the possibility of making a reconnaissance. At four in the afternoon of the last day, I met a traveller coming from the southeast and asked him where the *shui-shan* tree could be found. He told me that it could be got near a small village about 5 kilometers (3 miles) from where we were. Upon hearing this I almost broke into a run, intending to return to the inn before dark so that I might leave for Wanxian the next day. After trotting for a while, I met another peasant and asked him how far it was to the village. (I can't be sure now, but it may have been Nanpin village in Lichuan county.) "Five kilometers," he replied. Mountain people sometimes differ considerably in their gauge of distance.

I was wavering as to whether to go or not. If I should go, it was certain that I could not have returned to the inn before dark and that the innkeeper would worry. Then, too, I had already hired a man to carry the specimens for me; we had agreed on the next morning as the time for departure. I could not break my word! But finally I made up my mind to make another reconnaissance for *shui-shan*.

It was getting dark when I arrived at the small village. The villagers in their isolation seldom met outsiders, especially "intellectuals" such as I was. My arrival aroused their curiosity. They surrounded me, making all sorts of inquiries. But I was anxious to see the *Metasequoia* trees. When I was told that there were no such trees, I was very disappointed. However, I did not give up hope, and asked the villagers to accompany me to make one last reconnaissance. There was, indeed, no *Metasequoia*. I did collect some specimens of *Tsuga chinensis*, however.

I intended to return to the inn in spite of the dark night. However, the friendly villagers had already made arrangements for my food

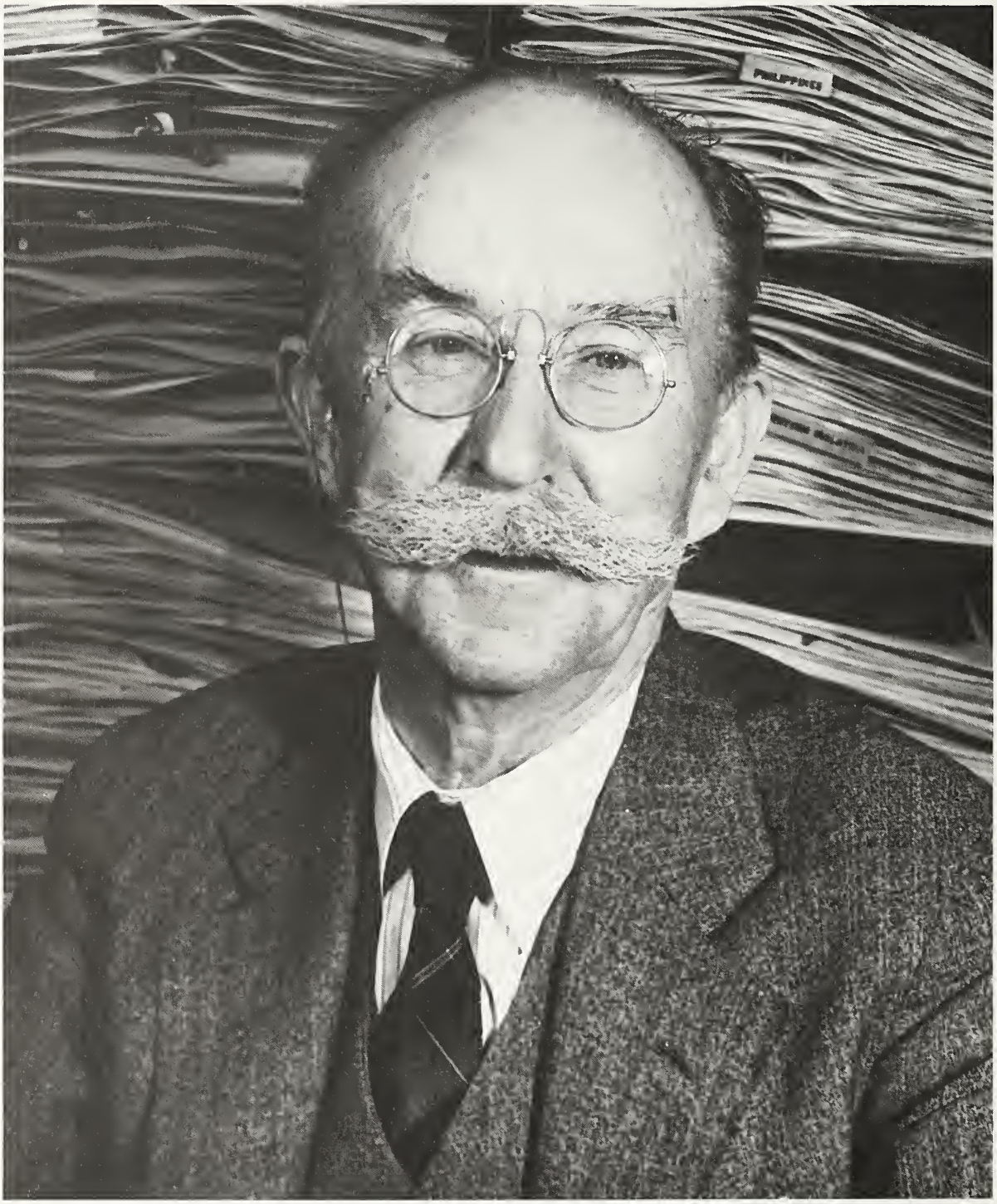
and lodging, and had warned me repeatedly of the frequent robberies on the way, insisting on my leaving the next day, escorted by some local people. Yet I could hardly fall asleep, thinking that I could not cause them so much trouble or break my word to the hired carrier. And then I thought that in the depth of the night there would be no "bandits," since there would be no travellers to rob. So at two in the morning I awoke my roommates, explaining to them the reason for my prompt departure, and left the villagers a letter of acknowledgment. Since the door was locked, I could only jump over the wall so as not to disturb others. In the moonlight I passed through stretches of dark pines, returning to the inn before dawn. That very day I left for Wanxian.

Geomancy Spared the Type Tree

Modaoqi was a very small village, to the southeast of which stood the Chiyue Mountains. Its altitude was 1744 meters [about 5755 feet]. At the time it was in Wanxian county, Sichuan province. It was so called because of its situation at the source of the river. As *modao* in Chinese means "knife-grinding" and suggests sinisterness, the name was changed to Moudao, which means "truth-seeking" in Chinese. At present it is under the jurisdiction of Lichuan county.

As the local people looked upon the *Metasequoia* as a sort of divine tree, they built a shrine beside it. Among the villagers there were quite a few traditions about the *Metasequoia*. As a result, the villagers considered its fruit-bearing condition to be an indication of the yield of crops, and the withering of its twigs or branches a forecast of someone's death. It was also rumored that, some time after the founding of the Kuomin Tang government, some foreign missionaries who were passing through the village were willing to buy the tree for a big sum of money. The villagers refused to sell, however, because of the geomantic nature of the place. Thus, it was because of feudalistic superstition that the tree had survived. Its age is estimated at four hundred years.

With the advent of well-regulated highway communication, the poor village of the former days changed its aspect long ago. The *Metasequoia* tree, which had survived the ravages of time and is reputed to be a "living fossil," has not only persisted, but is being disseminated. Now *Metasequoia* trees are "settled" in many countries of the world. It is only natural that people, when admiring this species of primeval tree, should wonder about its original habitat and should wish to know how it was discovered.



Alfred Rehder, photographed in 1939 by Dmitri Kessel. From the Archives of the Arnold Arboretum.

On the History of the Introduction of Woody Plants into North America

Alfred Rehder

This is one of the very few popular articles that Alfred Rehder ever wrote. While initially written in English in the early 1930s, it was never published because American horticultural magazines considered it too technical. Faced with this rebuff, Rehder published the article in Germany in 1932. In 1936, the Arboretum librarian, Miss Ethelyn M. Tucker, translated the article back into English for publication in the *National Horticultural Magazine*. While our knowledge of the history of the introduction of plants has increased considerably since Rehder's time, this work is still of value because it provides a firm foundation for future studies.

The introduction of North American woody plants into Europe has been treated frequently, while of the introduction of woody plants from other countries into North America almost nothing has as yet been written. It will, therefore, be appropriate to give here a brief sketch as to when and how foreign and also western American woody plants reached the gardens of eastern North America, as well as to mention the earliest and the most important gardens and arboreta.

The history of the introduction of ligneous plants into North America may be divided into three periods, the first of which embraces the time from the arrival of the first European settlers up to the middle of the 18th century. This period is characterized by the fact that the introduction of European woody plants is restricted chiefly to fruit trees and other useful plants with the addition of but a few ornamental shrubs. This is not to be wondered at since pioneers in a strange land have a hard struggle for existence and are forced to seek first to assure for themselves the necessities of life, and only with increasing wealth and security of possessions do they find leisure to think of beautifying their surroundings.

The first fruit tree introduced into the New World was the peach, which as early as the 16th century was brought into Florida by the Spaniards; from there it spread west and north and was planted by the white settlers as well as by the Indians. The introduction of woody plants in the North began in the first half of the 17th century. The first account of this we find in Josselyn (*New England Rarities Discovered*, published in 1672; and *Account of Two Voyages to New England* in 1638 and 1663, published in 1674) where he mentions the apple, pear, quince, cherry, plum, and barberry as thriving in New England; he mentions also *Salvia officinalis* and remarks that *Artemisia abrotanum*, rosemary, and lavender were not suited to the climate of New

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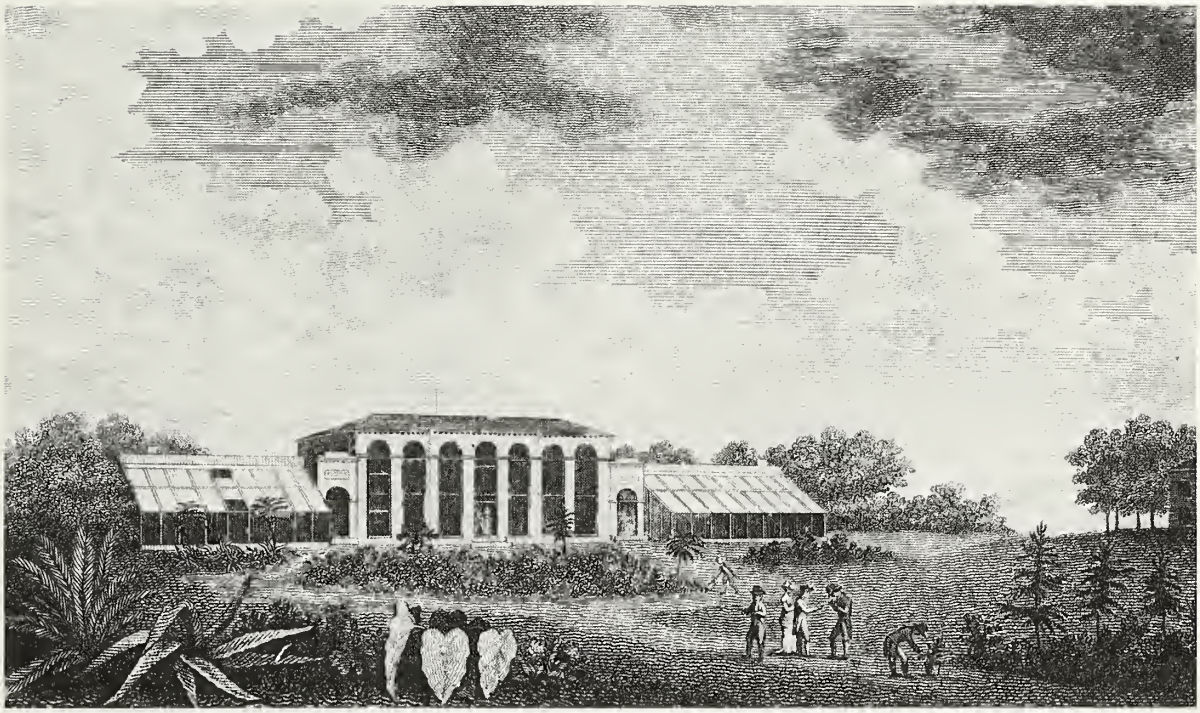
England, which shows that their introduction was attempted, but was successful only in the southern states. Of ornamental shrubs he mentions only the rose. We can, however, be almost certain that some other ornamental shrubs, such as the lilac, snowball (*Viburnum opulus* f. *roseum*) and box had already in the second half of the 17th century been found here and there, as in the garden of Van Cortlandt in Croton on Hudson established shortly after 1681, and in that of Peter Stuyvesant in New Amsterdam (New York) which was established somewhat earlier; but as to what other plants these gardens may have contained we have no knowledge. The sources of information concerning the garden plants of this period are very few and unreliable; it is, however, to be assumed that some native ligneous plants also were cultivated, especially shade trees such as sugar maple, elm (*Ulmus americana*), red oak, and farther south *Catalpa*. Here, too, it may be mentioned that in the year 1645 Endicott, Governor of Massachusetts, introduced *Genista tinctoria* as a dye plant, which soon escaped from cultivation and is now thoroughly naturalized in eastern Massachusetts.

The second period is characterized by the introduction of an ever-increasing number of ornamental trees and shrubs, exclusively, however, from European gardens, and may be considered as extending from the middle of the 18th to the middle of the 19th century. In this period two men are outstanding figures, pioneers in garden-craft. One is John Bartram, who in 1728 established a botanic garden at Kinsessing near Philadelphia, where he planted and cultivated American trees and shrubs, which he had collected in his travels extending from Lake Ontario to Florida. He was in active communication with England and introduced many American plants there; in exchange he received plants from European gardens and propagated them in America. Among these may be mentioned the horse chestnut, which probably came to America in the year 1746. His work was continued by his sons, John and William. Bartram's house and garden stand today, preserved in their original form. The second man is Robert Prince, who in the year 1730 founded a nursery in Flushing, Long Island, which has been managed continuously through five generations of the same family. Although in the beginning intended only for the raising of fruit trees, the management gradually broadened to include ornamental trees and shrubs, and since 1793 the nursery has been continued under the name Linnean Botanic Garden. From the catalogues which were issued it is evident what foreign trees and shrubs were in commerce at that time; from the catalogue of 1790 the following plants may be mentioned, though only the English names are given: *Cotinus coggygria, Koelreuteria paniculata, Colutea arborescens, Laburnum anagyroides, Populus nigra* var. *italica, Viburnum opulus* f. *sterile, Hibiscus syriacus*. In the earlier Prince estate still stand the oldest specimens in America of the cedar of Lebanon and Atlas cedar, *Paulownia*, the copper beech, Asiatic magnolias, and others.

Toward the middle of the 18th century, wealthy landowners, especially in Pennsylvania and Virginia, began to lay out large gardens in which among other things one finds box, lilac, *Taxus baccata*, and *Salix babylonica*. Washington's garden at Mount Vernon, begun about 1760, was one of the most important and contained many American and foreign trees and shrubs. One other very rich garden was laid out some years later by William Hamilton on his estate, "The Woodlands," near Philadelphia. This estate was later converted into a cemetery, "Woodlands Cemetery," in which today many of the trees planted by Hamilton still stand, among them the first *Ginkgo* in America which was planted in 1784. Humphry Marshall, inspired by his cousin, John Bartram, began in 1773 the foundation of an arboretum in Bradford, now Marshallton, in Pennsylvania. In 1785 he published his "Arbustrum Americanum," the first work written by an American on American trees and shrubs. Many of the trees which Marshall planted stand today. The first actual



A view of the Elgin Botanic Garden in New York City, established by Dr. David Hosack in 1801. Today Rockefeller Center in midtown Manhattan occupies the site on which the Garden once stood. From the Archives of the Gray Herbarium.

botanic garden in America was founded in 1801 by David Hosack in New York under the name "Elgin Botanic Garden." In the year 1810 it was taken over by the state of New York and later transferred to Columbia University, but was finally discontinued for want of funds. The second edition of the catalogue of this garden in 1811 contained many European and a number of Asiatic trees and shrubs, among which are *Gleditsia sinensis, Malus spectabilis, Rosa multiflora, Magnolia liliflora, Hydrangea macrophylla* (*H. opuloides*), *Sophora japonica,* and *Aucuba japonica,* the last two grown as greenhouse plants. A second botanic garden was established at the beginning of the 19th century in Cambridge, Massachusetts, and still exists at the Botanic Garden at Harvard University. In the year 1818 a catalogue of the garden by W. D. Peck was issued listing the following Asiatic trees and shrubs not mentioned in the catalogue of the Elgin Botanic Garden: *Vitex negundo* var. *incisa, Eriobotrya japonica,* and *Thuja orientalis.* Other eastern Asiatic trees and shrubs listed in Prince's catalogue for 1828 are *Ulmus parvifolia* and *Wisteria sinensis.* In the year 1806 an expedition under command of Lewis and Clark, sent to the west coast by the United States government, brought back to the East the first western American plants, which were distributed by Macmahon and Philip Landreth, two gardeners in Philadelphia; by far the most important woody plants so brought were *Mahonia aquifolium, Ribes aureum,* and *Ribes sanguineum.* At the beginning of the 19th century, a greatly increased interest in gardening and plant culture, and especially in the cultivation of trees and shrubs, was evidenced through the collection of ligneous plants begun in 1800 by the brothers Samuel and Joshua Pierce in Longwood, Pennsylvania, and through more than

50 years carried on by the family. The garden which still contains many of the trees planted by the Pierce brothers is now the property of Pierre S. du Pont [today it is part of Longwood Gardens]. Another well-known collection is the Painter Arboretum, near Lima, in Pennsylvania, founded in 1825 by the brothers Minshall and Jacob Painter, who extended and maintained the arboretum up to the time of their death in the 1870s. The garden exists today and contains, among other plants, the oldest specimen of *Sequoiadendron gigantea* in eastern North America.

In the year 1828, John Evans founded a garden on the Ithan Creek near Philadelphia and brought together a remarkable collection of trees, shrubs, and herbaceous plants. He corresponded with both Hookers, father and son, and exchanged seeds, and also received seeds of Himalayan plants which Joseph Hooker had collected. In the year 1841, Henry Winthrop Sargent bought the estate Wodenethe above Fishkill Landing in the state of New York and planted and attempted to raise all the conifers which he was able to obtain; from here was distributed *Pinus ponderosa* f. *pendula*. Another pinetum was established by Horatio Hollis Hunnewell, of Wellesley, Mass., in the year 1852, and is still maintained by the family. No garden in the eastern United States can boast a better collection of fine large specimens of various conifers.

Here also mention should be made of some famous nurseries such as that of Ellwanger and Barry in Rochester, New York, established in 1840; the nursery of Samuel B. Parsons and his brother Robert established at the same time in Flushing, Long Island; and later that of Thomas Meehan, in Germantown, near Philadelphia, in 1853. All these firms carried a large number of trees and shrubs and thereby made many of the plant treasures of European gardens available to American garden lovers.

A third period may be marked from the year 1861 in which the first Japanese plants were sent to America, and thereby direct communication with Japan and later also with China was initiated, countries which were destined to enrich American and European gardens through a large number of beautiful and valuable trees and shrubs. Up to this time America had received eastern Asiatic woody plants entirely by way of Europe, with the possible exception of a few important trees and shrubs such as *Rosa laevigata* Michx., which had previously come direct to America and by the end of the 18th century was already growing wild in the southern states. How it may have come there remains unknown.

In the year 1861, Dr. George R. Hall, who spent nearly fifteen years in China and had also visited Japan, sent a number of plants from Japan to America; in the following year he brought still more Japanese plants, some of which he sent to Parsons' Nursery in Flushing, some to Francis Parkman in Boston, and some he planted on his own estate in Bristol, Rhode Island, where many of them are growing today. Among the plants which he introduced may be mentioned some then not even known in Europe, as his *Malus Halliana, Magnolia stellata* and *M. kobus, Hydrangea paniculata* f. *grandiflora, Hypericum patulum, Taxus cuspidata* f. *nana, Sciadopitys verticillata, Phellodendron lavallei, Euonymus patens*, and *Lilium auratum*. Other Japanese plants were introduced by Thomas Hogg, the American consul in Japan in the years 1865 and 1873, and propagated in Parsons' nursery; among these *Cercidiphyllum japonicum, Hydrangea petiolaris, Symplocos paniculata, Magnolia parviflora*, and *M. obovata* (*M. hypoleuca*) deserve special mention.

In the year 1872, the Arnold Arboretum was founded as a department of Harvard University with Professor C. S. Sargent as Director, an institution whose purpose was to grow all the woody plants which would be hardy in the climate of Boston. All plants already cultivated in European and American gardens were collected and planted. As to those not yet found in cultivation, the director made it his aim to introduce from eastern Asia the rich ligneous flora up to that time only slightly known in western gardens. The first shipment

of seeds from eastern Asia was sent to the Arnold Arboretum in the 1880s by Dr. F. Bretschneider, who was physician to the Russian embassy in Peking. It consisted chiefly of trees and shrubs from the mountains west of Peking, among which may be mentioned *Syringa pubescens* and *S. villosa*, *Sorbus pohuashanensis* and *S. discolor* (*S. pekinensis*), *Deutzia parviflora*, *Rhododendron dauircum* var. *mucronulatum*, *Pyrus bretschneideri*, *P. betulifolia*, and *P. phaeocarpa*.

From Japan the Arboretum received in 1890, through Dr. William S. Bigelow, seeds of *Prunus sargentii*. Two years later, the director, Professor Sargent, visited Japan and brought back seeds of many trees and shrubs chief among which were *Rhododendron obtusum* var. *Kaempferi*, one of the most valuable introductions of the Arboretum, *Malus sargentii*, *Acer capillipes*, and *Sorbus alnifolia*. In the year 1905, J. G. Jack made a trip to eastern Asia and brought back, among other plants from Korea, *Rhododendron yedoense* var. *poukhanense*, *Tripterygium regelii*, and *Evodia daniellii*, and from northern China *Quercus aliena* and *Salix matsudana*. A year earlier the Japanese botanist Uchiyama had sent seeds of Korean woody plants to the Arnold Arboretum, among them *Abies holophylla* and *Neillia Uekii*. In the years 1907 and 1908, E. H. Wilson, who had formerly collected very successfully in China for the English nursery firm of Veitch, traveled for the Arnold Arboretum. Two years later he undertook a second journey to China, chiefly to western China, to collect seeds of conifers which in 1908 had borne no cones. During these three years Wilson sent more than 1,200 numbers of seeds to the Arnold Arboretum as well as a number of cuttings and young plants of *Populus* and *Salix* and some other woody plants. Many of the plants collected by him proved to be new not only to cultivation, but also to science. Wilson's new introductions and even those of horticultural merit are too numerous to mention here and only the following selection may be noted, among which are found some previously collected by him for Veitch: *Abies fargesii*, *Actinidia chinensis*, *Aesculus wilsonii*, *Berberis sargentiana*, and *B. triacanthophora*, *Cercis racemosa*, *Corylopsis veitchiana*, *Cotoneaster divaricata*, and *C. hupehensis*, *Dipteronia sinensis*, *Fagus lucida*, *Hydrangea sargentiana*, *Ilex pernyi*, *Jasminum mesnyi* (*J. primulinum*), *Kolkwitzia amabilis*, *Malus hupehensis*, *Populus lasiocarpa*, *Picea asperata*, *Rosa moyesii*, *Salix magnifica*, *Sargentodoxa cuneata*, *Sinowilsonia henryi*, *Sorbaria arborea*, *Spiraea veitchii*, *Styrax wilsonii*, *Syringa reflexa*, *Viburnum rhytidiphyllum*.

Also a part of the seeds of woody plants collected in eastern China by C. Schneider for the Austrian Dendrological Society in 1914 came to America owing to the interruption of communication with Europe by the World War. In the year 1914, Wilson went again to eastern Asia and this time to Korea and Japan. Of the Korean ligneous plants which he introduced, those deserving special mention are *Forsythia ovata*, *Pentactina rupicola*, *Stewartia koreana*, *Buxus microphylla* var. *koreana*, *Thuja koraiensis*, and *Syringa velutina*; of the Japanese ligneous plants may be named the numerous garden forms of Japanese cherries and the Kurume azaleas. From Formosa, which he visited in 1918, he introduced the only recently discovered *Taiwania cryptomerioides*, the tallest conifer of eastern Asia, a counterpart of the *Sequoiadendron gigantea* of California. In the years 1910 and 1911, William Purdom visited the northern provinces of China and sent back a large number of valuable seeds of ligneous plants, such as *Malus transitoria*, *Prinsepia uniflora*, *Berberis circumserrata*, and *B. purdomii*, *Sorbus koehneana*, *Deutzia grandiflora*, and *D. hypoglauca*, and *Picea meyeri*. The last collector for the Arnold Arboretum in eastern Asia was J. F. Rock, who in the years 1925 and 1926 collected in northwestern China, after he had previously traveled for the United States Department of Agriculture in southwest China, Burma, and Siam. Among the woody plants collected by him that were

The original introduction of the spreading Japanese yew, Taxus cuspidata *'Nana,' growing on the site of Dr. Hall's former estate in Bristol, Rhode Island. The specimen, planted in 1862, is now over 30 feet tall and 130 feet in circumference. Photo by P. Del Tredici, 1987.*

new to cultivation may be mentioned the following: *Juniperus tibetica, J. distans, J. glaucescens, Betula japonica* var *Rockii, Quercus laotungensis, Spiraea uratensis, Caragana brevifolia,* and *C. densa, Euonymus nanoides,* and *E. przewalskii, Rhododendron rufum,* and *R. capitatum.* During the sixty years of its existence, the Arnold Arboretum has introduced into American gardens some 2500 species and varieties besides the garden forms of *Syringa, Rhododendron, Rosa, Diervilla,* and others. . . .

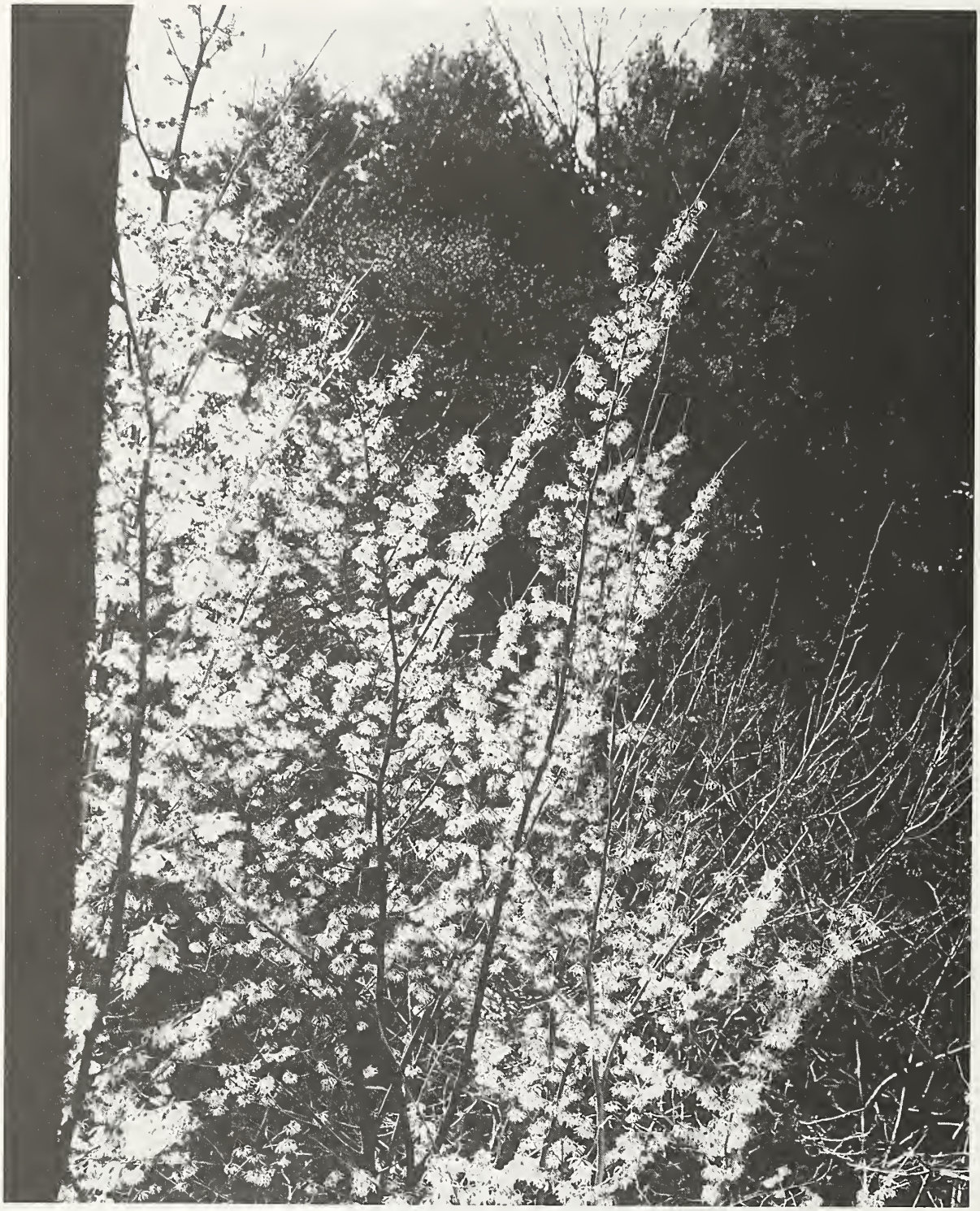
Also to the Department of Agriculture with its experiment gardens in different parts of the country, America is indebted for many new introductions of trees and shrubs through collectors sent to all parts of the world. One of the most successful of these collectors was Frank N. Meyer, who in the years 1907–1914 traveled in central and eastern Asia, where by accident he lost his life in the Yangtze River. Among his new introductions may be mentioned *Juniperus squamata* var. *Meyeri, Syringa meyeri, Albizzia kalkora, Betula chinensis, Buxus microphylla* var. *sinica, Daphne giraldii, Wisteria villosa.* The botanic gardens with arboreta connected, such as the Missouri Botanical Garden in St. Louis founded by Henry Shaw as a private garden and opened to the public about 1860, the New York Botanical Garden founded in 1894, and the Brooklyn Botanic Garden established in 1910, have contributed but little to the introduction of foreign trees and shrubs. The same is true of other arboreta founded in more recent times, as the Knox Arboretum in Warren, Maine; the Sanford Arboretum in Knoxville, Tennessee; and the Morton Arboretum,

in Lisle, near Chicago. The last named is, next to the Arnold Arboretum, the most important arboretum in the United States; in it are special plantations, largely of trees of value for forestry purposes, but it is also very rich in its collection of ornamental trees and shrubs.

From the preceding statements it is evident that the introduction to American gardens of most of the trees and shrubs was not direct from their native country but through the medium of European gardens. Not until the second half of the present century did introductions begin to be made direct. Even many American plants, especially those from the Rocky Mountains and from the western states, came by way of Europe into eastern American gardens. . . .

Of the woody plants introduced into North America from Europe and Asia, many have found conditions so favorable for their growth that they, especially in the eastern states, have to a large degree escaped from cultivation, and many are so well established that they actually form a part of the native flora. Among such woody plants that have become naturalized in many places may be mentioned the following: *Picea abies* (*P. excelsa*), *Salix fragilis, Populus alba, P. nigra, Alnus glutinosa, Berberis vulgaris, B. thunbergii, Ribes sativum, Philadelphus coronarius, Sorbaria sorbifolia, Malus pumila, Sorbus aucuparia, Crataegus oxyacantha, Pyracantha coccinea, Rubus laciniatus, Rosa canina, R. eglanteria* (*R. rubiginosa*), *Prunus persica, P. avium, P. cerasus, P. spinosa, Genista tinctoria, Cytisus scoparius, Ailanthus altissima* (*A. glandulosa*), *Euonymus europaea, Rhamnus cathartica,* and *R. frangula, Daphne mezereum, Solanum dulcamara, Ligustrum vulgare, Paulownia tomentosa, Lonicera caprifolium, L. japonica, L. tatarica, L. xylosteum, L. morrowii,* and many others. Their number increases from year to year so that in time the flora of the wooded areas, at least in the more densely populated regions, takes on a mixed character. For the most part, however, the foreign trees and shrubs will probably never become so predominant as is the case with herbaceous plants on cultivated and uncultivated ground in proximity to settled communities. Here the native plants are often almost crowded out by the European aliens, and when a European who has a knowledge of plants comes to northeastern America he will scarcely be reminded by the surrounding vegetation, so long as he stays in and near the cities and does not go out into the country, that he is in another part of the world.

In Europe this is far less the case; American plants have not become naturalized to such a degree as to change the character of the vegetation; in contrast to the European plants, the American plants appear to possess less vitality, which possibly may be explained by the fact that the European plants represent a geologically younger flora. The American plants belong in the main to the tertiary flora, while the European flora has developed and spread since the ice age. But the European and Asiatic flora will also change with time. As a consequence of the intercourse between the different countries ever becoming closer, one may expect that an increasing mixture of floras of each of the climatic zones will take place and that finally each climatic zone around the world will have more or less the same or similar vegetation, as this is already the case today to a higher degree in the tropics than in the temperate zone.



The original plant of Hamamelis *'Arnold Promise' in full bloom. Photo by Ràcz and Debreczy.*

Hamamelis 'Arnold Promise'

Richard E. Weaver, Jr.

In recent years, this early spring-blooming shrub has become a sensation on the American gardening scene. In his article, Dr. Weaver, a former Arboretum taxonomist, presents the story of the development of this striking hybrid as only a "parent" can.

In botanic gardens and arboreta, plants of closely related species are often grown in close proximity for display, educational, or research purposes. Hybridization between species results much more commonly in such situations than in the wild where the habitats of the same species may be separated by hundreds or even thousands of miles. Over the years many interesting and valuable ornamental plants have arisen in gardens through the unknowing intermediacy of the honey bee, making its daily rounds. *Forsythia x intermedia*, for instance, a hybrid between *F. suspensa* and *F. viridissima*, was first observed to be growing in the Göttingen Botanic Garden in Germany around 1885. Since then, the hybrid has been recreated many times, and has given rise to most of our common garden forsythias. In the same way, a number of plants have arisen at the Arnold Arboretum, including among them one of the finest shrubs ever to originate on its grounds.

In 1928, William Judd, the propagator at the time, collected seeds from a plant of the Chinese witch hazel (*Hamamelis mollis*). Its parent plant, illustrious in itself, had been grown from seeds collected by E. H. Wilson in China in 1905. The resulting seedlings turned out to be not *H. mollis*, but rather appeared to be hybrids. The pollen parent (analogous to the father plant) was eventually determined to have been a closely adjacent plant of *H. japonica*, the Japanese witch hazel. Alfred Rehder in 1944 named the hybrid *H. x intermedia* because its character was intermediate between its parents. Seven plants grew from the original hybrid seeds collected by William Judd in 1928. The colors of the flowers varied from reddish through copperyorange to yellow. Most bloomed rather sparsely, and the flowers on others were partially obscured by persistent withered leaves, an unfortunate trait inherited from their Chinese parent. But one was spectacularly different with its profuse, slightly fragrant, clear yellow flowers. Its merit was eventually recognized and it was given the clonal name 'Arnold Promise'.

In general, witch hazels are large shrubs and small trees with a scattered distribution in eastern North America and eastern Asia. Four species are usually recognized. Although they are rarely grown as ornamentals in this country, they are extremely valuable because of their unique blooming times. Our native common witch hazel (*Hamamelis virginiana*) blooms from early October through mid-December in good seasons. In some years the Ozark witch hazel (*H. vernalis*) overlaps slightly, but it normally commences to bloom in early January. The extremely fragrant

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A close-up of the flowers of 'Arnold Promise.' Photo by Ràcz and Debreczy.

blooms of the Chinese species follow closely near the end of January, and the Japanese species ends the season with its flowers in March. The bright but not spectacular, fragrant flowers of witch hazel would perhaps not be much appreciated if they appeared during the riot of May, but they are a treasure in the drab winter. Its four strap-shaped petals appear very delicate but they are unharmed by sub-freezing temperatures. They merely coil up like a spring on unusually cold days and recoil with more temperate weather.

Hamamelis 'Arnold Promise' is the very best of the early-blooming witch hazels, at least for New England gardeners. It is a far better plant than either of its parents, particularly

in regard to its flowering. The flowers of *H. mollis* are individually more attractive and they are extremely fragrant. But they are seldom profusely borne in our climate and they are often damaged by severe cold. The flowers of *H. japonica* are larger, but they are rather dull-colored. The flowers of 'Arnold Promise' are unusual among witch hazels in that the spidery petals spread more or less downward rather than outward. They are consistently borne in great profusion, even after the coldest of recent winters, appearing from mid-February to early March depending on the season. The habit of the plant is also better than that of most witch hazels. The original plant, now 52 years old, is a shapely, broadly vase-shaped shrub with numerous, gently ascending stems. It is presently about twenty feet tall and almost as broad. The autumn foliage is the color typical of many of its genus—clear, bright yellow—and the withered leaves never persist into the winter.

The ornamental merit of 'Arnold Promise' has only recently been recognized, and it is just beginning to be available in the nursery trade. The original plant is still tucked away in a corner of the Administration Building out of view from the passing public. However, its modest position, close at hand, keeps it always in mind of the staff of the Arboretum. They see in it, as Donald Wyman put it so well, "an old friend, known for its performance, counted on because it has been there a long time, and not considered unusual for these reasons." But the 'Arnold Promise' is special. Its promise is the promise of spring.

Forsythia intermedia *'Spectabilis.' Photo by Ràcz and Debreczy.*

The *Forsythia* Story

Donald Wyman

During his years at the Arboretum, Donald Wyman was not only the horticulturist but also the first editor of *Arnoldia*, a post he held for twenty-nine years. Wyman did more to define and communicate the purpose of the Arboretum to the general public than any other staff member since the days of Sargent and Wilson. In this article one gets a taste both of his distinctive style and of the breadth of his knowledge.

Forsythia suspensa sieboldii was the first forsythia introduced into Europe from the Orient, going to Holland in 1833. Unquestionably, it was popular. Here was a new plant with brilliant yellow blossoms each spring, always dependable. It was soon learned that in good soil it would have more blossoms than in poor soil, but even when the growing conditions were difficult, it would grow into an interesting, green-leaved bush which was not susceptible to serious inroads from insect or disease pests.

As time went on, and more horticulturally-minded individuals visited the Orient, other species were introduced. *Forsythia viridissima* was brought from the Orient by Robert Fortune in 1844.

It is of interest to note that other species have not contributed much to the beautiful cultivars we grow today. The European Forsythia of Albania is not outstanding and was not even "discovered" until 1897. Two years later it was introduced into England. China is the habitat of both *Forsythia suspensa* and *F. viridissima*, as well as *F. giraldiana*, which was not introduced until 1914.

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Korea is the homeland of *Forsythia ovata* (introduced to America by E. H. Wilson of the Arnold Arboretum in 1918), as well as *Forsythia viridissima koreana* (introduced in 1917), and *F. japonica saxatilis* (introduced in 1924). Although most of these have probably been grown in Japan for centuries, *F. japonica* is the only species native to that country. None is native to North America. So the two introduced species growing in Europe by 1850 (*suspensa* and *viridissima*) can be considered to be the "ancestors" of the many cultivars we are growing today. Undoubtedly these two species were grown side by side in several places and, of course, eventually had the opportunity to hybridize.

Then the great Späth Nurseries in Berlin, Germany, became interested in growing seedlings. The seeds were collected from plants which obviously had an opportunity to hybridize, and in 1885 the hybrid species *Forsythia intermedia* was described. Seedling selections were made by Späth in this group and several were introduced. These were more upright and vigorous in growth than the arching *F. suspensa*, and several of the new hybrids produced larger and more profuse flowers. Also, some clones were selected because they

had lighter (or darker) yellow flowers than had been noted before.

Because these plants grew rapidly and were easily propagated by cuttings, they were widely distributed, and some have been popular ever since.

The parade of "new" varieties started in 1899 with the introduction of 'Vitellina' by the Späth Nurseries. It will be noted that this is not one of the best for ornamental purposes in modern gardens (*Arnoldia* 19: 11-14, 1959). This was quickly followed by the introduction of 'Densiflora' by Späth in 1899, long a popular plant. Now it is superseded by others. Two years later 'Decipiens', a poor-flowered clone of *Forsythia suspensa*, originated at Späth's, but it never proved popular.

However, in 1906 this same nursery introduced *Forsythia intermedia* 'Spectabilis' which was extremely popular right from the start, and has been so to the present time. For a profuse display of deep golden yellow flowers, this is the one that any new cultivar has to beat when it comes to critical comparisons. Never before had any forsythia produced as many flowers or such deep-colored flowers as did this new hybrid selection. Another selection of *F. suspensa* named 'Pallida' appeared in Germany in 1906 and merited some attention at the time because the flowers were a much lighter color than those of the more popular 'Spectabilis'.

During the ensuing years, these forsythia were, of course, being grown in the United States, and in the Arnold Arboretum an attempt was made to grow them all. There, about 1912, a new seedling was found and later named 'Primulina'. This was another cross between *Forsythia suspensa* and *F. viridissima* and was appropriately named because of its pale yellow flowers. Many liked it, especially those who did not prefer the strikingly brazen yellow of 'Spectabilis'.

In Mentor, Ohio, a suburb of Cleveland, a gardener of some note by the name of M. H. Horvath had been experimenting with plants for several years, growing new seedlings, selecting some and discarding others. In his garden there was a plant of 'Primulina' which he watched carefully from year to year. In 1930 he noted that one branch consistently produced larger flowers than those on the rest of the bush, and they were certainly more densely arranged. Cuttings of this were taken, producing plants that were superior to 'Primulina' and about 1942 this was introduced to the trade by Wayside Gardens of Mentor, Ohio, as 'Spring Glory', a plant that has been one of the most popular of all forsythias ever since.

The forsythia story continued on the other side of the Atlantic, in a beautiful garden called Lynwood in northern Ireland, where the owner, Miss Adair, was growing, among other things, a plant of *Forsythia* 'Spectabilis'.

Miss Adair noted that a branch of this plant had flowers that were more open and better distributed along the stem than were those of the rest of the plant. Cuttings were taken and grown by the Slieve Donard Nursery of Newcastle, Ireland, and named 'Lynwood' about 1935 in honor of the estate where it originated. Unfortunately, in the early years it was not properly described, and somehow or other, by 1949 when it had reached America, where supersalesmen are sometimes overly anxious to coin new plant names, the name was changed to 'Lynwood Gold'. The plants are the same. This cultivar is known all over England as 'Lynwood', and in America as 'Lynwood Gold'. It, too, is one of the most popular forsythias at the present time.

Back in America, the New York Botanical Garden enters the story, for slightly before 1939 an extremely dwarf forsythia was found there. This was named *Forsythia viridissima* 'Bronxensis' by T. H. Everett in 1947. It was early to bloom, but difficult to propagate and grow properly, an unfortunate characteristic, since all forsythias are commonly considered easy to grow.

At the same time, Dr. Karl Sax of the Arnold Arboretum became interested in the *Forsythia* clan and started treating some plants with colchicine and hybridizing others. Many seedlings were grown; a few have been named.

Forsythia suspensa *f.* pallida. *Photo by Ràcz and Debreczy.*

'Arnold Giant' was produced by treating a seedling of *Forsythia intermedia* with colchicine. The resulting plant was a tetraploid, but it was unfortunate that it was ever named and released. Although vigorous, it proved too rigidly upright and was hard to propagate by cuttings. Two years later, in 1941, a very dwarf forsythia was produced as a cross between *F. intermedia* and *F. japonica.* This roots extremely easily, makes an excellent plant for banks, and is now widely available. It was named 'Arnold Dwarf'.

More crossing and experimenting on the part of Dr. Sax and his students and careful examination of earlier seedlings brought to light another seedling, a cross between 'Arnold Giant' and *Forsythia ovata.* This was a triploid, first called 'Farrand' by Dr. Sax and later changed to 'Beatrix Farrand' at the request of Mrs. Beatrix Farrand, for whom it was named. This produces dense clusters of flowers, is upright and dense in habit, slightly darker in flower than 'Spectabilis' under some conditions, and now widely popular. During these years, several seedlings were sent out for trial by the Arboretum and one, which was a cross between 'Arnold Giant' and an unknown forsythia, proved to be a tetraploid and was noted as being hardier in the Midwest. This was named 'Karl Sax' by Dr. J. L. Thomas of the Arnold Arboretum for Dr. Sax, who originated it.

The Swiss nursery firm of Mertens and Nussbaumer named 'Mertensiana' in 1949, but it has not proved a very desirable ornamental. A variegated form of *Forsythia viridissima* originated in England some time before 1951, and a more ornamental cultivar of *F. suspensa atrocaulis* was selected and named 'Nyman's Variety' in 1954, in honor of the beautiful estate in the south of England where it originated.

Undoubtedly yellow-leaved plants have appeared in the past, most of them suffering severely when exposed to full sunlight, but the one which has been named *F. intermedia* 'Aurea' (1958) was found in a garden near the Beardslee Nurseries of Perry, Ohio.

And so it is seen how two species introduced into Europe from the Orient before 1850 started a colorful procession of cultivars. Many individuals, in widely separated places, have been responsible for the selections. Others yet unknown may have tried crosses without striking results. Certain it is, however, that although several species have been introduced from the Orient since 1900, it is chiefly *Forsythia suspensa* and *F. viridissima* from China which have been largely responsible for the best of the forsythias grown today.

Buckleya—The Oldest Cultivated Plant in the Arnold Arboretum

Richard A. Howard

While not a particularly important plant from either an economic or a horticultural point of view, *Buckleya distichophylla*, or the piratebush as it is now called, is nonetheless a semi-parasitic plant of some mystery that intrigued both Asa Gray and Charles Sargent. In this article, Dr. Howard, Director of the Arboretum from 1954 to 1978, manages to blend history, botany, and horticulture into a classic plant portrait.

Although the Arnold Arboretum was legally established in 1872, the first plantings on the grounds did not occur for several years. It is of interest, therefore, that a plant collected in Tennessee by Asa Gray in 1843 was transplanted to Hemlock Hill in Jamaica Plain in 1946 and so represents the oldest documented cultivated plant in the Arnold Arboretum. Strangely, it is a semi-parasitic plant with an unusual history. It is not common in cultivation, has no well-known common name, and is to be recommended only for its oddity.

Buckleya distichophylla (Nutt.) Torrey was first seen by Thomas Nuttall in his travels along the French Broad River in East Tennessee in 1816. Nuttall, an English-American botanist and ornithologist, was to become the director of the Harvard Botanic Garden in Cambridge, Mass., in 1822, preceding the more famous Asa Gray. His discovery was described by him as *Borya distichophylla* in his book *The Genera of North American Plants* in 1818. Unfortunately, he assigned it incorrectly to a genus in the Oleaceae, the olive family.

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The plant was found again in the spring of 1843 by Samuel Bradford Buckley, a naturalist and plant collector for Professor John Torrey of Columbia College. Torrey then correctly assessed the plant to represent a new genus of the sandalwood family, Santalaceae, and named it *Buckleya* in honor of Mr. Buckley. Torrey recognized that the proper specific name was that published earlier by Nuttall, and made the transfer and new combination. Professors Torrey and Gray had published *A Flora of North America*, containing short descriptions of all the known indigenous and naturalized plants growing north of Mexico, and were continuing a program of collecting unusual plants. Thus Gray sought out *Buckleya* in the fall of 1843 and returned with herbarium specimens and plants and fruits of the rare *Buckleya* for cultivation at the Harvard Botanic Garden, then under his direction. The introduction to cultivation of a living partially parasitic plant is unusual, yet it was successful. Herbarium specimens from this plant labelled "Hort. Cantab." or "Botanic Garden of Harvard University" are dated 1852, 1879, 1926, and 1930; the last two, by John George Jack for the Arnold Arboretum herbarium.

Buckleya distichophylla. *Drawing by C. E. Faxon, first published in* Garden and Forest *3, p. 237, 1890. From the Archives of the Arnold Arboretum.*

Charles Sargent was the director of the Botanic Garden of Harvard University in Cambridge from 1873 until 1879, and there he prepared plans and plants for the development of the Arnold Arboretum property in Jamaica Plain. One can assume that Sargent noted the lack of fertile fruits on the *Buckleya* in the botanical garden and attempted vegetative propagation. When this was unsuccessful, he sought additional plants from the wild, and in 1888 he and W. M. Canby made a trip across the Smoky Mountains of Tennessee, including a "detour to the French Broad for the purpose of looking up *Buckleya*." He reported that he found plants in ripe fruit at Paint Rock and sent back several hundred seeds packed in damp soil as well as a number of small seedlings. All arrived at the Arboretum in good order, and the seeds germinated "at once." These accessions were recorded in the numbered inventory of the Arnold Arboretum as "#3255," a plant collected by Sargent at Paint Rock, Tenn., Oct. 1888, and "3255-1 seeds" from the same area. Herbarium vouchers of fruiting specimens support the collection data. We have no record of the length of time the plants or seedlings obtained by Sargent were maintained in the living collections, for the existing records show only the undated annotation "dead or

disposed of," representing a period when non-ornamental plants were removed from the living collections.

Sargent wrote of his search for this plant and of its introduction to cultivation in an article on "New or Little Known Plants" in *Garden and Forest* in 1890. A plate prepared by Charles Faxon was included and is reproduced here. *Buckleya*, as a native plant, was not included in any edition of *A Manual of Botany* as prepared by Asa Gray, although several of these editions included the state of Virginia, where the plant has been found. It was first mentioned in the eighth edition of *Gray's Manual of Botany* published by M. L. Fernald in 1950. Sargent mentioned the plant only briefly in a footnote in his *Silva of North America. Buckleya* is included in Rehder's *Manual of Cultivated Trees and Shrubs*, but supporting specimens for this record are only those of the Botanic Garden of Harvard University.

When the Botanic Garden in Cambridge was abandoned in favor of university-sponsored housing at the end of World War II, the shrub introduced by Asa Gray in 1843 and cared for by Charles Sargent in 1873 was transplanted to the grounds of the Arnold Arboretum in 1946. It continues to thrive in a natural stand of *Tsuga canadensis*, the Canada hemlock.

Buckleya is a genus of dioecious shrubs, the male and female flowers occurring on different plants. The specimen Asa Gray collected is a female plant. *Buckleya* is known to be a semi-parasitic plant, that is, during part of its development it is dependent as a parasite on the attachment of its roots to those of other plants. The plant becomes a shrub, has green leaves, and does manufacture its own food. I have not been able to locate a 19th-century reference to this parasitism, but herbarium specimens from the Biltmore Herbarium, collected in 1897, were made deliberately to show the haustorial connection with *Tsuga canadensis*. Since the natural range of *Buckleya distichophylla* is also that of the Carolina hemlock, botanists speculate that *Tsuga caroliniana* might have been the original host plant. In the last decade, other botanists have reported an association of *Buckleya* with species of *Pinus*, and, in fact, as many as twenty-five different forbs, grasses, and ferns as well as broad-leafed trees. Even today it is not clear at what stages of growth or for how long or to what degree *Buckleya* must be dependent on a host plant.

Sargent reported in 1890 the lack of success in attempts to propagate vegetatively the specimen of *Buckleya* in the Botanic Garden in Cambridge. Since that time the Arnold Arboretum has acquired several seed lots of *Buckleya distichophylla* from native locations and from other plants in cultivation in the United States, and one infertile seed lot from the Forest Botanic Garden, Charlottenlund, Denmark. Mr. Fordham, longtime plant propagator for the Arnold Arboretum, has conducted many experiments with this species. In spite of Sargent's early report that seeds germinate "at once," Mr. Fordham has found that seeds failed to germinate when planted directly upon receipt. However, seeds given a cold treatment of 40 degrees for two or three months produced seedlings in over 50 percent of the cases. In 1962, a generous quantity of seeds and cuttings was received from Mr. Fred Lape from plants growing in the George Landis Arboretum in Esperance, New York. Mr. Lape wrote that the original plants in his collection came from seed collected by F. M. Crayton of Biltmore, North Carolina; they germinated well and are established in the Landis Arboretum as well as in an old woodlot. He reported that in one place "there is a spread of it the size of a small room," and that the large plants fruit heavily each year.

The cuttings received rooted poorly under mist propagation and developed roots only at the very base of the cutting. Other cuttings treated with Amchem 60-89 diluted to 5000 ppm produced better roots. The seeds developed and the seedlings appeared to flourish without a *Tsuga* or any other host plant present in the container. Thirty-five of the vigorous seedlings were planted on Hemlock

A young, vigorous Buckleya distichophylla *seedling, raised from seed sent by the George Landis Arboretum in Esperance, New York, in 1978 (AA #166-78). It was planted in a pot with a Canada hemlock (seen on the left) in 1980, and planted outdoors in 1983. Photo by P. Del Tredici, 1986.*

Hill in the Arboretum in 1963, but by the fall of 1964 all had died. Other seedlings planted near a hemlock in the nursery area persist to the present but have yet to flower and so are unsexed. Regrettably, these plants, even if staminate, are too far from the older pistillate plant for normal cross-pollination.

The fruits of the American *Buckleya distichophylla* are drupes resembling a small olive in size and shape. When mature they are a yellow-green in color and they turn a tan or light brown color on drying. The fruits may possess four narrow lanceolate bracts at the summit which are shorter than the fruit. These often fall early but if they persist are certainly of no aid in dispersal.

In 1846 the German botanical collectors Philip Siebold and Joseph Zuccarini described in their *Flora of Japan* a plant they called *Quadriala lanceolata*, literally referring in the name to the four large bracts found on the fruit. Friedrich Miquel, in 1870, recognized this plant to be of the same genus as *Buckleya distichophylla* of the United States and published the combination. Thus *Buckleya* was recognized as one of the many genera occurring in the southeastern United States and in Japan and China. *Buckleya distichophylla* is known today from Tennessee, Virginia, and North Carolina. *Buckleya lanceolata* (Sieb. & Zucc.) Miq. is known from Japan (Honshu) and China (Hona, Hupeh, Shensi, Szechwan) with a possible second Asiatic species, *B. graebneriana* Diels from Shensi in China. Two other species from Asia have been referred to *B. lanceolata* in herbarium annotations made by Rehder.

In 1892 on a collecting trip to Japan, Charles Sargent found fruiting specimens of *Buckleya lanceolata* on the steep banks of the Kisogawa near Agematsu in Nagano prefecture of central Honshu in Japan. Upon his return Sargent wrote in *Garden and Forest* of the Japanese *Buckleya:* "Indeed it is so common in some parts of the country that the fruit, which is gathered when about two-thirds grown, having been subjected to some pickling or preserving process, is sold as a condiment, packed in small, neat wooden boxes. Nikko is the headquarters of the industry, and in late autumn the fruit of *Buckleya* is displayed in many of the shops which line the street leading through the straggling village up to the burial place of the founder of the dynasty of the Tokugawa Shoguns. To appreciate the flavor of *Buckleya*, the culture and refinement of the Japanese palate is essential." There is no record of the seeds Sargent described being grown at the Arnold Arboretum, but in 1905, John George Jack, Sargent's colleague, returned to the same area and obtained comparable fruiting herbarium specimens. It appears that both men might have attempted to introduce this species into cultivation. In 1964 the Arnold Arboretum received fruits of *Buckleya lanceolata* from the Kobe Municipal Arboretum in Kobe, Japan. After a cold treatment of 40 degrees for three months, several seeds germinated, but the seedlings could not be established. In 1902 the Japanese botanist, S. Kusano, in an article in the *Journal of the College of Science of the Imperial University of Tokyo*, noted that no information had been published on the host plants of *Buckleya* or for the abundant local species. He described the haustorial connections with species of *Cryptomeria, Abies*, and *Chamaecyparis* as well as nine genera of dicotyledonous trees and shrubs. Although he did not locate naturally occurring parasitism with *Pinus* or *Torreya*, he was able to establish such relationships experimentally.

Buckleya lacks a common name and never will be widely cultivated or useful as an ornamental plant. It is, however, a good example of a rare plant of limited distribution showing unusual phytogeographical relationships, representative of a small family, and worthy of a place in the educational collections of an arboretum. The oldest cultivated plant in the Arnold Arboretum also has a historical connection with several of America's distinguished botanists.

The Allegheny Pachysandra

Michael A. Dirr and John H. Alexander III

While everyone knows the common pachysandra, used so often as a groundcover, few realize that it is native to Asia, and fewer still realize that it has a beautiful, horticulturally neglected American cousin. Mike Dirr was spending a sabbatical leave from the University of Georgia at the Arnold Arboretum when he wrote this article with Jack Alexander, who is currently the Arboretum's plant propagator.

Repetition seems to be the rule with groundcovers, for the same taxa are used repeatedly, and few attempts have been made to educate the public or to offer alternative selections. *Euonymus fortunei* 'Colorata', *Hedera helix*, *Pachysandra terminalis*, and *Vinca minor* are the dominant offerings and comprise probably 50 percent of the total groundcovers used in the East and Midwest. None of these is without problems and in recent years *Pachysandra terminalis*, Japanese pachysandra, has been afflicted with *Volutella pachysandrae*, a fungal pathogen, that causes cankers and stem dieback. A severe infestation can devastate an established planting. Controls are available, but often by the time the homeowner recognizes that a problem exists, it is too late for effective treatment. The monoculture of trees should have taught us something; however, it appears as though the same type of mistake is being repeated with groundcovers.

An American species, *Pachysandra procumbens*, Allegheny pachysandra, is one of the most handsome plants for groundcover use, yet is seldom seen in gardens or in commerce. This fact has been lamented by other authorities, and the species suffers a fate common to other quality plants: entrapment in the confines of an arboretum or botanic garden. Two reasons for the lack of visibility are the limited publicity compared to its Japanese cousin and the purported difficulty of propagation. Division, which is the traditional means of increase, is excessively slow for commercial purposes.

The plant was discovered by André Michaux in the 1790s and was described in his now classic *Flora Boreali-Americana*. Its range was listed as the western Allegheny mountains; hence the derivation of the common name. In 1937, Braun noted that the species is found in Kentucky, Tennessee, northern Alabama, Mississippi, and northern Florida. The species also occurs in North and South Carolina. Wherry studied native stands of Allegheny pachysandra from Somerset, Kentucky, south to the Gulf of Mexico. He noted that the plant abounded on rocky slopes, being most at home in woods, but persisted even where trees had been cut and land pastured. The underlying rock was limestone and soil reaction was circumneutral (around pH 7). According to Wherry, most plants were situated on slopes along streams.

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The contrasting foliage of Pachysandra procumbens *(above) and* P. terminalis *(below). Photos by M. Dirr.*

The species is hardy far north of its range and is successfully cultured at the Morton Arboretum, Lisle, Illinois, as well as at Champaign-Urbana, Illinois, where temperatures may reach -20 to -25 degrees Fahrenheit. A planting has been maintained since 1962 at the University of Minnesota Landscape Arboretum where winter lows reach -30 degrees Fahrenheit; however, snow cover is usually constant and affords protection.

The Arnold Arboretum has plantings that have not been disturbed since June, 1943. One measures 3 by 4.5 feet, and another, 3 by 7 feet. The former is on the east side of the Hunnewell Building while the latter is on the north side and hemmed in by the parking lot and building so it can spread in only two directions. There is no evidence of any disease or insect problems in the plantings. The species' extreme shade tolerance is evidenced by the excellent performance in these locations. Under landscape conditions, a moist, well-drained, organic, slightly acid soil would probably prove optimum. Any plant that increases by rhizomes or underground rootstocks benefits from a loose, friable soil because there is less physical impediment to the expanding structures.

Summer foliage ranges from a grayish- to bluish-green with a slight mottle and does not possess the luster of Japanese pachysandra. The leaves assume a bronze color in the late fall and by winter's termination range from greenish-brown to brown. The foliage is not truly evergreen and may vary from deciduous to semi-evergreen. Leaf retention depends on siting and geographic location. The species forms a handsome carpet that varies from 6 to 10 inches in height. If the foliage deteriorates over winter, abundant new shoots will have developed to form a solid cover by May or June. The leaves are much wider than the Japanese species and display more prominent (coarser) serrations. Although alternate in arrangement, the leaves appear whorled because the nodes are so closely spaced. They range in size from 2 to 3.5 inches long and are almost as wide.

The flowers are especially attractive and develop in March and April on 2- to 4-inch-long spikes that emanate from the base of the stem. A single stem may have up to three spikes, but one is more common. The position of the flower provides another means of separating the two species, for on Japanese pachysandra the inflorescence is at the top of the stem in the middle of the pseudo-whorl of leaves. The flowers of *P. procumbens* are a purplish- or pinkish-white (stamens may be pink in color) and possess a pleasing fragrance. Wherry termed the odor rancid and musky, but based on personal observation this is not the case. The flowers are unisexual and apetalous with male and female on the same inflorescence. A few female flowers are confined to the base of the inflorescence while the conspicuous and abundant stamens occur at the top. Both species have naked (not hidden by bud scales) inflorescences, which are formed the summer and fall prior to flowering. Unfortunately if the Allegheny pachysandra is killed to the ground, the flowers will be lost. Even though they are basal, they elongate and partially rise above the foliage which is often flattened by winter weather. The early flowering date couples the species with *Acer rubrum* and together they could be considered "harbingers of spring."

Fruits are not showy and apparently seldom develop in cultivation. Examination of herbarium specimens of material collected from the wild showed that the fruit is a three-valved capsule that contains small lustrous, dark brown seeds. The fruit is not ornamental on either species, but perhaps controlled crosses might be made between the two, thus resulting in interesting hybrid progeny.

The Cornell Plantations reported in 1978 that Allegheny pachysandra was unfamiliar to many visitors and stimulated more questions than any other plant in their groundcover collections. They further noted that the species was not evergreen in Ithaca, New York, but was perfectly hardy, and that twelve-year-old plantings showed no disease or dieback problems.

Propagation difficulties may have limited commercial offerings in the past, but this is no longer a problem. Cuttings of vigorous semi-hardened growth taken in June have rooted readily. In experiments at the Arnold Arboretum, cuttings collected in September rooted no less than 80 percent in eight weeks when placed in sand and perlite under mist. Ten treatments were employed and even the controls rooted, but indolebutyric acid (IBA) and naphthaleneacetic acid (NAA) when applied as dips (pure chemical dissolved in 50 percent ethanol) resulted in 100 percent rooting and large root systems.

Allegheny pachysandra is an aesthetically functional alternative to the more common groundcovers.

Notes on Persimmons, Kakis, Date Plums, and Chapotes

Stephen A. Spongberg

As horticultural taxonomist at the Arboretum for over twenty years, Dr. Spongberg's interests are very wide ranging. Among them are the persimmons, a group he came to admire during the course of his many trips to the orient.

The genus *Diospyros* is not at present an important genus of ornamental woody plants in North America, and while native persimmons once were valuable fruits in the eastern United States, the fruits produced by *Diospyros* species no longer are important food items in the American home. In the countries of eastern Asia at least two species of *Diospyros* are among the most common trees encountered in dooryard gardens and orchards, where they are cultivated for their edible fruits as well as for other uses and for their ornamental beauty. J. J. Rein, a German traveler and author, wrote in 1889 that *Diospyros kaki* Linnaeus f. was "undeniably the most widely distributed, most important, and most beautiful fruit tree in Japan, Korea, and Northern China." And in Japan, where *D. kaki* is second in importance as an orchard crop only to citrus fruit, the kaki often is referred to as the national fruit.

The rarity with which species of *Diospyros* are found in cultivation in cool-temperate North America is partially due to the fact that most are native to regions of tropical and subtropical climate and are not hardy in areas of temperate climate. A member of the Ebenaceae or Ebony Family, the genus contains upwards of 400 species that occur in both the Old and New Worlds with the greatest concentrations of species occurring in Madagascar (over 100 species), in Malaysia, and in Africa. The relatively few species native to regions of temperate climate come primarily from eastern Asia, but two species, *D. virginiana* and *D. texana*, are indigenous to the United States.

A second reason even the hardy exotic and native species are rarely cultivated undoubtedly is related to a general lack of knowledge concerning when and how the fruits can be eaten, stored for future use, and prepared. While I always begin to look for persimmons in local markets and on Arnold Arboretum trees as the fall advances, many persons' experiences with these fruits understandably end when they first bite into a hard, astringent, and puckery persimmon. Such disappointments no doubt have contributed to a lack of demand for persimmons in American markets.

Despite the fancy prices asked for oriental persimmons or kakis in local vegetable stands and supermarkets, I am hopeful this article will stimulate enough interest to encourage readers to buy and enjoy a persimmon or two

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The American persimmon, Diospyros virginiana, *growing at the Arnold Arboretum. Photo by Ràcz and Debreczy.*

and to experiment with different ways of serving, and perhaps, preserving them. If native or American persimmons grow nearby, they can be gathered at little or no cost. I also am hopeful that both the oriental and American species will be more widely planted both for their fruits and as biologically interesting ornamentals.

Characteristics of Hardy Exotic and Native Persimmons

The genus *Diospyros*, the name derived from the Greek *Dios*, of Zeus or of Jove, and *pyros*, grain, in allusion to the sweet fruits fit for the gods, consists of trees and shrubs, and while some are evergreen plants, all of the species considered below are deciduous. The wood of the majority of species is very hard with a watery sap, and the heart wood is often blackish. The heart wood of several of the tropical species, especially that of *D. ebenum* Koenig ex Retzius, is the source of ebony, a hard, black wood often used for piano keys and for other inlaid cabinetry work and undoubtedly the most widely known product of this otherwise little-known genus. . . .

The sexuality of persimmon trees and the production of persimmon fruits are poorly understood and in need of further detailed study. From what is known, persimmons are a biologically intriguing example of a variable and complex reproductive system. In general, the staminate and carpellate flowers are restricted to different individual plants, and the species is classified as dioecious (i.e., two households, male and female individuals separated). However, in some instances, flowers of both sexes occur on a single individual plant, a few branchlets of an otherwise carpellate tree bearing staminate flowers or vice versa. Under these circumstances the species is said to be monoecious (i.e., one household, separate male and female flowers on the same plant). Yet another added complexity in *Diospyros* is that some plants consistently produce flowers of both sexes, but others change from year to year, producing flowers of both sexes in one year, but not in another. In still other, rarer instances, a few perfect flowers, that is, flowers that contain both functional male and female parts, may occur on staminate or carpellate plants or on plants producing both carpellate and staminate flowers.

Flowering occurs in late spring and early summer, usually during late May and June in the Arnold Arboretum, and swarms of small honey bees have been noted to work the flowers during this period. Due to their small size, their nodding position in the leaf axils, and also because of their greenish and whitish to yellowish color, flowers of *Diospyros* are often unnoticed, and it may be only the activity of large numbers of insects visiting the flowers for pollen or nectar or both that draws attention to the fact the trees are in flower.

Initially green, hard, and with their high tannin content, extremely astringent, the fruits and their subtending calyces increase in size as the season progresses and gradually assume their mature color and texture. Depending on the cultivar, the fruits may ripen any time between July and December or even February, and contrary to some reports, frost apparently is not necessary to reduce astringency or to hasten ripening. As a matter of fact, some cultivars of the oriental persimmon or kaki are sweet and edible when still green and hard, looking like, and with the texture of, green apples.

Ripe persimmons may either contain seeds or, surprisingly, be totally free of seeds. Fruits containing seeds probably result from the normal sexual process whereby the egg cells contained in the ovules of the ovary of a carpellate flower are fertilized, and seeds and fruit develop. Seedless persimmons, on the other hand, develop without fertilization. The development of fruit without fertilization and hence without seeds is known as *parthenocarpy*. What factors are necessary to trigger parthenocarpic development in persimmons is not known to me and constitutes another aspect of the variable and complex reproductive mechanisms of the genus.

Moreover, circumstantial evidence involving a presumably totally carpellate tree of *Diospyros virginiana* in the Arnold Arboretum that regularly produces seed-filled fruits, yet is a considerable distance from the nearest staminate tree, suggests the possibility that some seeded fruits also may be produced without pollination and fertilization. The latter type of asexual seed production, termed *apomixis*, is known in some plant families, but has not been documented in *Diospyros* or the Ebenaceae. It might explain some of the variability of some species of *Diospyros*, including the kaki, and help in interpreting taxonomic complexities of the genus.

The species of *Diospyros* known to me to be cultivated in cool-temperate regions of eastern North America are discussed individually below. . . .

1. *Diospyros virginiana* Linnaeus, Sp. Pl.2: 1057. 1753. The American persimmon, common persimmon, simmon, or possum wood, is native to a wide area of the eastern United States, from southern New England and Long Island south to southern Florida, and westward into eastern Iowa, Kansas, Oklahoma, and eastern Texas. Infrequent in southern New England, it reaches the northernmost limit of its natural distribution at Lighthouse Point in New Haven, Connecticut, but it is hardy further north and can be cultivated successfully throughout USDA Zones 5a and 5b. Common south of New England both east and west of the Allegheny Mountains, *Diospyros virginiana* is particularly plentiful in the southeastern states where it often invades fallow fields and forms dense thickets along roadsides, spreading by means of black, fleshy, stoloniferous roots. The trees usually grow in sandy, well-drained soils, but also occur in rich, wet soils of bottomland forests.

An extremely variable species over its wide range, the American persimmon occasionally develops a shrublike habit, but generally is a small tree to 10 or 15 meters, rarely to 35 meters, often with spreading and pendulous branches. The bark, hard and of a brownish or blackish color, is irregularly and deeply fissured into small, blocklike plates, and resembles that of the flowering dogwood, *Cornus florida* L. . . .

The fruits of the American persimmon vary in size from that of a small cherry to that of a large plum about 4 centimeters in diameter, and in color from orangish to pinkish-yellow, often with a grayish bloom when ripe, to dark purple or bluish-black in f. *atra* Sargent. The fruits are an important food to many forms of wildlife, and opossums, raccoons, and squirrels often strip the trees of any fruits remaining on the branchlets during the winter months. The fruits also were important food items to the Indians of eastern North America as well as to the first European settlers and explorers. Easily grown from seed, American persimmons were sent back to England and established in English gardens some time before 1629.

The Spanish explorer Don Fernando de Soto learned of the food value of the persimmon from the Indians of Florida in 1539 and probably was the first European to write about the fruit. In the next century, Captain John Smith, among others, took an interest in the *putchamins* of the Indians, and likened them to medlars (*Mespilus germanica* L.), noting that "if it not be ripe it will drawe a mans mouth awrie with much torment; but when it is ripe, it is as delicious as an Apricock." The name *putchamin*, L. H. Bailey suggests, probably is a phonetic rendering of the Indian name for the plant.

Hedrick, in his *History of Horticulture in America to 1860*, states that "of the several plants used by the Indians, two, the persimmon and sassafras, were of importance to the [colonists] of Maryland and Virginia." European settlers in the southern states prepared a persimmon or simmon beer and used the fermented juice to distill an apparently very good brandy. In Pennsylvania, Isaac Bartram wrote a treatise on the preparation of persimmon wine. Persimmons also were eaten when ripe, or prepared in puddings, breads, or as preserves, while dried persimmons were

An old tree of Diospyros lotus, *approximately 26 meters tall, growing at the base of Fei-Yüeh-ling, Ching Chi Hsien, western Szechwan Province, China. Photo by E. H. Wilson, 1908. From the Archives of the Arnold Arboretum.*

stored and eaten as we eat figs and dates. The wood of the common persimmon has been valued for its hardness and density and has been used locally for innumerable items; it once was preferred for shuttles over any other American wood.

During the 19th and early 20th centuries, considerable interest centered on the American persimmon as a potential orchard crop, and numerous cultivars, selected for fruit color, taste, size, and early maturation, were selected from wild populations and named. . . . While interest in cultivars of *Diospyros virginiana* has continued to the present day, primarily in the Midwest, to my knowledge American persimmons never have been grown successfully on a commercial scale. Undoubtedly, this in large part is due to the fact that the American appetite for persimmons is limited, and the California-produced oriental persimmons satisfy the current market demand. Nonetheless, local native and occasional cultivated trees help to satisfy those of us who enjoy our native persimmon. . . .

2. *Diospyros lotus* Linnaeus. Sp. Pl. 2: 1057. 1753. The date plum, *Diospyros lotus*, is very similar to the American persimmon in its morphology and may be the closest living relative of our native species. . . . In the Old World, *D. lotus* is very widely distributed as a native, naturalized, or cultivated plant from southern Europe, the Caucasus, and Asia Minor eastward through the northwestern Himalayan region, and into China, Korea, and Japan. In cultivation since ancient times, the natural occurrence and original distribution of *D. lotus* no longer are possible to ascertain. In England and other areas of northern Europe, the date plum has been cultivated as an ornamental since the 16th century. In North America, the date plum is hardy at least as far north as the Boston area. It probably was introduced into North America when seeds were received at the Arnold Arboretum in 1884 from the Imperial Botanical Garden at St. Petersburg.

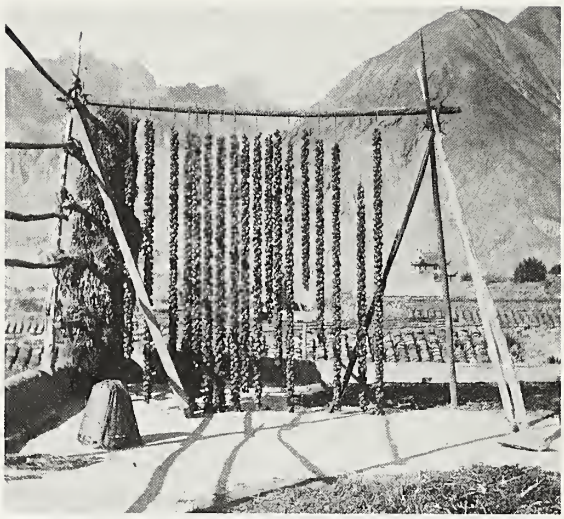
A small tree, usually with a rounded crown, that with age may attain 30 meters in height, *Diospyros lotus* is valued in Asia for its small, yellowish-brown to bluish-black fruits, which have a taste similar to dates and often are dried for winter consumption. The Chinese name for the species, *Ghae tsao*, signifies black date. The fruits attain a diameter of about 2 centimeters, and those I have examined or eaten always have been almost completely filled with brown, oblong, and flattened seeds. F. N. Meyer, a plant collector for the USDA, reported a seedless type from China. The date plum is especially valued in eastern Asia as an understock onto which scions of the oriental persimmon are grafted.

Diospyros lotus grows, either as a native or naturalized plant, in rocky, protected ravines,

along mountain streams, and on rocky slopes. In Japan I saw a fruiting and healthy-appearing tree growing from a crevice in a rock outcrop on the Pacific Ocean beach at Matsushima. The date plum may prove of value as a small ornamental tree in coastal areas where salt spray limits the effective use of other ornamental species.

3. *Diospyros kaki* Linnaeus f., Suppl. Pl. 439. 1781. The kaki, Chinese persimmon, Japanese persimmon, or oriental persimmon, with fruits sometimes the size of large tomatoes, is the persimmon that occasionally appears in American markets and abounds in markets in Japan, Korea, and China during the late summer and fall and into winter. Like the date plum, kakis have been cultivated for such an extended period of time that the natural species range has become totally obliterated. Grubov, a Russian botanist, has suggested that the wild progenitor of the cultivated forms was native to northern China, while Rehder and Wilson in *Plantae Wilsonae* (1916) state that *Diospyros kaki* var. *sylvestris* Makino, the reputed wild form of the kaki, with smaller, yellow, and often hairy fruits, is "abundant in the mountains of central and western China up to 4000 feet altitude, where it forms a large tree 50 or 60 feet tall." . . .

That selection for differing fruit types has occurred is evidenced by the upwards of a thousand cultivars or forms of the kaki that are cultivated in Asia and maintained by ring-budding or grafting, primarily on date plum rootstock. Ranging in size from about 2 centimeters in diameter, the size of a small plum, to about 8 centimeters in diameter with a weight of over a pound, kakis can be astringent or sweet, seedless or seeded, and conical, round, flattened, or almost cubical in shape, and some cultivars have longitudinal or horizontal ridges or furrows. The 'Tamopan' or grindstone persimmon is one of the bizarre forms, with an equatorial to near basal furrow, while the more regular, oblong-conical fruits of 'Hachiya' with rounded apices terminating in small, black, stylar scars, are probably the most common kaki in American produce markets.



Cords of peeled persimmons (Diospyros kaki) *hung up to dry in the village of Siku, Kansu Province, China, where the local name,* Fang sze tze, *signifies "square persimmon." Photo by F. N. Meyer, 1914. From the Archives of the Arnold Arboretum.*

As noted previously, the astringency of persimmons is a variable character caused by tannins that, depending upon the cultivar, may or may not be present when the fruits are green and hard. Some forms never lose their astringency, even when soft. The tannin-bearing cells are scattered in strands throughout the flesh of the fruit, and the tannin is associated with a mucilage-like carbohydrate that coagulates and "absorbs" the tannin during ripening. Oxidation of the absorbed tannin causes the tannin-filled cells to turn red in some cultivars; the strands of cells are then easily distinguished. Kaki fruits are also very high in vitamin C and sugar content (glucose ca. 18 percent), the latter a variable character, like astringency, but have relatively low percentages of protein and fat. In Japan, hard, astringent persimmons were sometimes placed in used sake casks or tubs to ripen, and these "tub persimmons," which absorbed the flavor and perfume of the sake, were considered a delicacy. However, the Japanese appar-

ently often ate the hard, unripened fruit, a fact that prompted Charles Sargent to observe that the kaki was "consumed in immense quantities by the Japanese, who eat it, as they do all their fruits, before it is ripe, and while it has the texture and consistency of a pavingstone."

Unlike Americans, who regard the kaki as a fresh fruit to be eaten when ripe or, more rarely, frozen for later use, the peoples of eastern Asia for centuries have dried the fruits for storage and use during the winter and early spring months. The persimmons, either whole or sliced, and occasionally skinned, are dried in the sun until their flesh attains the consistency of a dried fig. I have seen sliced persimmons drying on wooden platforms on rooftops in Korea, while a photograph taken by Frank N. Meyer, Agricultural Explorer in China for the U.S. Department of Agriculture early in this century, shows the fruits strung on stout cords and suspended from a simple scaffold to dry in the sun and wind. . . . Meyer's photographs also document another way in which the persimmon is used. In certain areas of China, the sugar, which collects on the cut surfaces of the dried kakis, is compacted into thin, round cakes or loaves and then pressed into molds to produce ornamented tablets. The Chinese characters on the surface of the tablets photographed by Meyer signify "double happiness"; couples engaged to be married often present these tablets to friends from whom they have received wedding gifts. The tablets of sugar also are served as one of the eight comestibles offered with tea during the first course of traditional Chinese banquets.

The kaki is grown in Asia for more than its edible fruits. Numerous medicinal properties have been attributed to different parts of the plants. The green unripe fruits of what in China is known as the oil persimmon, *Diospyros kaki* var. *sylvestris*, the reputed wild form of the domesticated kakis, are used to make a varnish oil that renders hats and umbrellas waterproof. In Japan, Shibu, a highly astringent, milky, light or dark gray fluid rich in tannin, is prepared from unripe kakis and date plums during the summer and is used to toughen paper, wood, and fishnets. It also is required in one stage of the complicated process of making fine Japanese lacquer work and in the preparation of sake and certain dyes.

Sir Joseph Banks, botanist on Captain James Cook's first voyage around the world, is credited with the introduction of *Diospyros kaki* into Europe, while the first trees of the kaki in North America probably were grown from seeds obtained in Japan by Commodore Perry in 1856. Likened by some to an apple or pear tree in size and shape, but with larger, lustrous green leaves that turn scarlet in the fall, when it is particularly handsome with its brilliant fruits, the kaki was considered by Sargent to be the most beautiful of any fruit tree of cold temperate climates. Knowing that the kaki is hardy in Peking, Sargent speculated that it would be hardy in New England "if plants of a northern race can be obtained." Unfortunately, kakis, even some grown from seed obtained near Peking, never have survived in the Arnold Arboretum for longer than a few growing seasons. . . .

4. *Diospyros texana* Scheele, Linnaea 22:145. 1849. Unlike the carpellate flowers of the American persimmon, the date plum, and the kaki, carpellate flowers of the chapote, black persimmon, or Mexican persimmon lack sterile stamens or staminodia. Moreover, the flowers appear on the branchlets of the previous year's growth, and the anthers of the staminate flowers open by short, apical slits, while those of the other species dehisce by longitudinal slits that continue down the entire length of the anther. These differences help to distinguish *Diospyros texana* from the other species of the genus and were considered by John K. Small of enough significance to merit placing *D. texana* in a separate, monotypic genus, *Brayodendron*. However, most botanists have continued to regard the chapote as a unique species of *Diospyros*.

The chapote further differs from the other species discussed in this article in its shrubby,

Square tablets of persimmon sugar obtained from the dried fruits of a variety of Diospyros kaki *with the Chinese name* Pen sze sse. *The Chinese characters signify "double happiness." Photo by F. N. Meyer, 1914. From the Archives of the Arnold Arboretum.*

often many-stemmed habit, although it may develop into a single-stemmed twiggy tree that occasionally reaches 25 meters in height. The bark of the chapote also is distinctive; it is smooth, light reddish-gray or reddish-brown, and the outer layers exfoliate in irregular sheets, exposing the smooth, gray, inner bark. In appearance, it is reminiscent of the mottled bark of the crape-myrtle (*Lagerstroemia indica* L.) and is one of the characters that recommend the chapote as an ornamental plant.

Native to the United States, the chapote is distributed in central and western Texas and ranges southward into the Mexican states of Coahuila, Nuevo León, and Tamaulipas. Over its range it grows in rich moist soils of bottomlands as well as on dry rocky mesas and in isolated canyons. The small, hairy, black fruits mature to 2.5 centimeters in diameter. When mature, they are sweet but rather insipid. According to Paul Standley, they leave an "indelible black stain upon everything with which [they] come in contact" and have been used by Mexicans of the Rio Grande Valley to dye sheepskins.

Sargent notes that this species should prove valuable as a cultivated ornamental for its attractive, lustrous foliage, the interesting black fruits of the carpellate plants, and its mottled bark. It is recorded as cultivated in Virginia and in Pennsylvania, and although it has not yet proven hardy at the Arnold Arboretum, it may be hardy as far north as southern New England.

In Praise of the American Smoke Tree

Gary L. Koller and Don O. Shadow

Just as a prophet is without honor in his own land, so it is with this plant. Under only the rarest of circumstances will one find this beautiful southeastern native growing outside of a botanical garden. As Arboretum horticulturist Gary Koller and Tennessee nurseryman Don Shadow explain, this is an injustice that cries out for remedy.

Have you ever wondered why one introduced species within a genus flourishes in the nursery and landscape industry while a native American plant with notable traits remains obscure? An example of this occurs in the genus *Cotinus*. *Cotinus coggygria* Scop., the common smoke tree or smokebush, whose native range extends from South Europe to Central China, is frequently seen in residential landscapes here. It is sought after because of its many fine qualities: a long period of midsummer floral and fruit ornamentation, showy plumose fruit panicles (which create the smokelike effect that gives the plant its common name), vivid autumn foliage colors, ease of culture, and longevity (the oldest plants extant at the Arnold Arboretum are 108 years old and healthy). Our native American smoke tree, *C. obovatus* Raf., on the other hand, is rarely seen. It is often missing even in the horticultural literature. Older books on landscaping omit it completely. When it is included, it is described in almost disparaging terms: "the fruiting panicles are not showy . . . it is useful only for autumn color . . . where the smaller smoke tree will suffice, the American species can be omitted." Writers always attempt to compare the American species with its Asian relative. We have observed fruit panicles in the wild that are quite showy, though it is fair to say that those on the Arboretum's trees are not. We shall lay comparison aside here and give our native species the attention it deserves.

Robert A. Vines, in his book *Trees, Shrubs, and Woody Vines of the Southwest*, states that *Cotinus obovatus* occurs on "rocky limestone hills of Texas, Oklahoma, Arkansas, Missouri, Alabama, Tennessee, and Kentucky. Nowhere very abundant or widespread." Thomas S. Elias, in *Trees of North America*, says that it generally grows in limestone soils of dry, rocky slopes, in mountain canyons, or on high hills. It is found at elevations up to 1000 meters. Because it inhabits locations with hot humid summers and relatively mild winters, many assume that it will not thrive under the soil and climatic conditions of northern landscapes. Yet we have found a planting as far north as the Landscape Arboretum at the University of Minnesota. Dr. Harold Pellett, on the staff there, told us that the arboretum had had success with seed of a cultivated plant from the Morton Arboretum in Lisle, Illinois, in 1963. Today, one of the resultant seedlings, which grows in an exposed site, is nearly 5 meters tall. It is stem hardy at temperatures above approximately

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The multistemmed habit of the Arboretum's staminate American smoke tree. Note the scaley texture of the bark. Photo by Barth Hamburg.

-25 degrees Fahrenheit. The minimum temperature at which the roots are cold hardy has not yet been determined. Information on the original native locale of this plant is unavailable. A more cold-hardy genotype may yet be found.

A second welcome feature of the American smoke tree is its adaptability to various soil conditions. In Tennessee it occurs on south-facing rock outcroppings of limestone, where the pH is 6.5 to 7.0. Very little soil is present on top of the rocks, so the roots must invade the cracks and crevices to anchor the plant and obtain moisture and nutrients. In the same area it also grows in sites with better soil, where it associates with *Juniperus virginiana, Rhus aromatica, Viburnum prunifolium, Cercis canadensis,* and *Quercus prinoides.* At the Arnold Arboretum a 102-year-old specimen flourishes in highly acidic soil near the edge of a meadow. Peter Del Tredici, of the Arnold Arboretum staff, observed the plant thriving in alkaline clay soils in the Chicago area. Excess soil moisture, however, may detract from optimum autumn foliage coloration. . . .

The fall-foliage colors of this tree are stunning. At the Arnold Arboretum few plants match it in terms of brilliance and intensity. In full sun the colors are scarlet, orange-scarlet, and claret; and in shade apricot, gold, and yellow. A. C. Downes acclaimed the plant for its fall colors in 1935 in *The Gardeners' Chronicle:* "seen with the autumn sun shining through its translucent leaves, decked out in all shades of flaming orange and scarlet, it has been a sight not easily forgotten. . . . It is just the translucent quality of its foliage that causes the warm fiery glow that is its great charm. Other plants can show colors as vivid in themselves (as, for example *Rosa nitida),* but their thicker leaf blades rob them of the wonderful effect." . . .

Soil moisture and soil nutrition seem to affect autumn brilliance. One writer suggested that when grown on rich soil that is high in nutrients, the resultant lush, soft growth produces poor fall color. A. J. Anderson, in a 1945 issue of *The Gardeners' Chronicle,* said, "the most beautifully colored examples I have seen are growing on an exposed, dry bank of poverty-stricken soil. A moist, rich medium should definitely be avoided as it always results in vigorous, sappy growth which is detrimental to autumn coloring." Fall weather also seems to affect color brilliance. At the Arnold Arboretum, one plant varies from very colorful to dull depending on sunlight and temperatures in early October. In the wild, autumn color varies substantially from one plant to the next. . . .

The bark of the American smoke tree provides pattern and detail in the winter landscape. Bark plates have bases lifted slightly and pulled away from the stems, creating a

The oldest and largest specimen of the American smoke tree growing at the Arnold Arboretum, raised from seed collected in 1882. This staminate plant is nine meters tall, with several major stems. Photo by Rácz and Debreczy.

fish-scale-like effect. The scale pattern varies among individuals, and the plant could benefit from selection for this characteristic. Plants must reach approximately 20 years of age before the mature bark pattern develops. At this point the plant can be pruned to expose the bark to view. The bark can be an interesting focal point of a winter landscape. The tree can also be planted en masse to create a mini-forest of textured stems.

Cut logs of the American smoke tree match *Juniperus virginiana* in durability and longevity and have been used as fence posts and walking sticks. When the tree is cut for logs or burned over by fire, the stump has the ability to resprout quickly, resulting in multistemmed specimens. As a result, most wild plants are multistemmed and not very straight. Color on freshly cut wood samples varies from bright yellow to pale orange. Extract from the wood was an important source of a natural dye, especially during the Civil War period.

Flowers and fruit are borne in large terminal panicles. Attached to the upper end of each panicle are slender stalks clad in fine hair. These create the smokelike effect, which in the wild varies in color (from light brown to fleshy tones and pale purple), size, and density. The sexes occur usually on separate plants but occasionally on a single plant. In the horticultural literature the male plant is reported to be superior for "smoke production." All of these factors suggest that selection could produce a more beautiful tree. Fruiting is said to be sparse in the wild. Seed is often difficult to find, as squirrels gather it before it ripens.

The height of the plant varies considerably, though this may be attributable to environmental conditions. The largest plant documented is a national champion tree at the Deane Hill Country Club in Knoxville, Tennessee. The tree is 13 meters high, with a crown spread of 10 meters, and a trunk girth of 1.5 meters The oldest and largest plant at the Arnold Arboretum came from seed sent by Charles Mohr of Mobile, Alabama, in 1882. As of February 1984, this plant stands 9 meters tall, with a crown spread of 8 meters and with five stems arising from ground level, of which the largest two are 45 centimeters in circumference. In poor soils and under harsh environmental conditions in the wild, the plant can be found in spreading thickets free of other species. Such varied growth habits allow great opportunity for the selection of individuals for specific purposes.

Elliottia Racemosa and Its Propagation

Alfred J. Fordham

Alfred Fordham was the propagator at the Arboretum from 1958 to 1976. During this time he built up a reservoir of knowledge about plants and their propagation that few people are able to match. In this article, Al Fordham displays the skill that earned him his well-deserved reputation.

Elliottia racemosa, the Georgia Plume, is a small tree or large shrub in the Ericaceae or Rhododendron family, native to the state of Georgia. A review of the literature concerning it reveals a history of frustration and disappointment. Despite the fact that it was discovered 160 or more years ago, and despite the fact that its impressive ornamental characteristics have been often described, it is still exceedingly rare in cultivation. It has been reported to have lost its ability to produce seeds, to be difficult to transplant (even in areas where it is native), and to have failed in most propagational efforts. For a time *Elliottia* was considered lost.

Elliottia was discovered in Waynesboro, Georgia, by Steven Elliott who was in the process of preparing his "Sketch of the Botany of South Carolina and Georgia." Other stands were later found in the same region and across the Savannah River in South Carolina. Mr. P. J. Berckmans, of Augusta, Georgia, moved several plants to his nursery and from these succeeded in propagating a few by using root cuttings. Through the cutting of the woods and the clearing of land for agriculture, the original stands of *Elliottia* disappeared. Dr. Charles S. Sargent wrote, "The range near Augusta is now entirely barren of *Elliottia*. Unless another locality is found, I should not be surprised if the species is preserved only on P. J. Berckmans' grounds." Dr. Asa Gray also visited the region and wrote, "Not a vestige of *Elliottia* (in Columbia county) remains. A small patch is said to exist in Edgefield county, South Carolina, but all efforts to find it have failed." Fortunately the threat of extinction no longer exists, for a number of stands have been found more recently both in the area of the original find and also down into central Georgia.

Two attempts were made to establish *Elliottia* at the Royal Botanic Gardens, Kew, England. The first in 1894, consisting of a few plants donated by Mr. Berckmans, resulted in failure while the second in 1902, from the same donor, led to the establishment of two specimens. J. Robert Seeley, writing in *Bartonia* (1938), spoke of one remaining plant at Kew Gardens as the only representative of its species in Britain and possibly in Europe as well. He also noted that every effort to propagate *Elliottia* at Kew had failed.

Propagation of *Elliottia racemosa*

In 1962, while visiting Mr. Henry Hohman of Kingsville Nursery, Kingsville, Maryland, we viewed his two plants of *Elliottia* and discussed its propagation. A month or so later,

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The original specimen of Elliottia racemosa *sent to the Arboretum by Henry Hohman in 1962. Photographed in full bloom by Ràcz and Debreczy in 1988.*

Mature seed pods and viable seed of Elliottia racemosa. *Photo by P. Del Tredici.*

the smaller of the two, a fine eight-foot specimen, arrived at the Arnold Arboretum from Mr. Hohman with his suggestion that we work out methods for its propagation. While at Kingsville Nursery, we discussed the use of root cuttings in the propagation of *Elliottia*. When Mr. Hohman dug the plant, he did not fill the resulting crater but let it remain. He thought that the severed roots left in the crater wall might produce shoots. This worked well, and in 1963, eighteen plants were harvested from within the crater.

Mr. Hohman's plant has prospered at the Arnold Arboretum and it flowers profusely each year. It should be added that *Elliottia* has not proven hardy at the Arnold Arboretum. Our accession records show that all prior efforts to establish it have ended with the notation, "winter killed." Alfred Rehder in his *Manual of Trees and Shrubs* considered *Elliottia* a Zone 7 plant. Therefore, our specimen is lifted each autumn and placed in a cold storage unit.

Propagation by Seeds

Some years, fruit capsules appear on our *Elliottia*, while in other years there are none. They, however, have always been devoid of sound seeds.

In October of 1962, several fruit capsules matured on Mr. Hohman's remaining plant and he sent them on to us. By carefully pick-

ing them apart, we obtained eleven plump seeds which appeared viable. These were sown without pretreatment. By March of 1964, they had all decomposed.

In June of 1964, several capsules were received from Miss Claremont H. Lee of Savannah, Georgia. Some were light brown in color while others were of darker hue. This difference would indicate that those light in color were from the 1963 fruit crop while those more weathered were from the previous year. The seeds were carefully separated from the capsules and some appeared well filled and sound. Cut tests were not made since those seemingly viable were so few. The seeds were divided into two lots: Lot #1 was sown without pretreatment, while Lot #2 was provided with a two-month period of cold stratification at 40 degrees Fahrenheit. One seedling germinated in Lot #1. When Lot #2 was sown, one seedling also appeared. After five months in the greenhouse, no further germination took place so Lot #2 (which still contained sound seeds) was placed in our winter cold storage unit for three months. The temperature there is maintained at about 34 degrees. It was then returned to the greenhouse and after a lapse of three months, three more seedlings appeared. This behavior leads one to suspect that *Elliottia* seeds might be doubly-dormant or two-year seeds. However, the sample was far too small for this to be other than a suspicion.

Propagation by Cuttings

Repeated attempts were made to root stem cuttings of *Elliottia* using an assortment of root-inducing substances and a variety of timings. Success was mediocre. The next effort was to test whether or not root pieces would produce multiple shoots. Shoots that arise from roots are physiologically juvenile and will usually root despite the fact that stem cuttings from the same plant will not. With this fact in mind, root sections about 3/8 inches in diameter and about 4 to 5 inches long were taken from the plant when it was dormant. They were placed horizontally about half an inch deep in flats of sandy soil. This was done on March 24 and by May 19, multiple shoots began to appear. The pressure of spring work was such that cuttings were not taken from the roots until July 14. By this time they were firm and woody.

The first crop of cuttings was divided into two lots. Lot #1 was treated with a product containing 3 milligrams of IBA in a gram of talc with Thiram added. Lot #2 was treated with a similar formulation but with 8 milligrams of IBA. In each case all cuttings rooted. The root pieces were left in place and continued to produce shoots for over a year. The largest root pieces that we could get from our plant were only about 3/8 of an inch in diameter and these produced well. It seems reasonable to suppose that, if root sections of larger diameter were used, the crop of shoots could be vastly increased. Root cuttings have not presented survival problems and all have prospered.

If propagators set root pieces horizontally in flats, as described above, and gather the easily rooted shoots as they appear, there seems no reason why this beautiful subject should not become commonly established in cultivation.

Propagating Leatherwood: A Lesson in Humility

Peter Del Tredici

Part of being a good propagator means being able to listen to what the plants are "saying." This brief article by former propagator Peter Del Tredici makes that point nicely.

It is often assumed that because I work in the greenhouses of the Arnold Arboretum, I should be able to solve any plant-propagation problem that comes along. With all that heat and light, the reasoning goes, you should be able to make dead sticks sprout. Unfortunately, technology is not always the most effective solution to the difficulties that arise with plants. This fact was brought home to me rather dramatically recently in attempting to determine the seed-germination requirements of *Dirca palustris*, the Atlantic leatherwood.

This beautiful little shrub in the Thymelaeaceae family is native to the east coast of North America, from New Brunswick to Florida and east to the Mississippi. In the wild, *Dirca* tends to form dense thickets in the forest understory, growing best in moist areas that have a high limestone content. Henry David Thoreau tracked the plant down in its native haunts in Brattleboro, Vermont, on September 8, 1856:

> . . . for the first time I see growing indigenously the *Dirca palustris*, leather-wood, the largest on the low interval by the brook. I notice a bush there seven feet high. In this form it is somewhat like a quince bush, though less spreading, its leaves are broad, like entire sassafras leaves; now beginning to turn yellow. It has remarkably strong thick bark and soft white wood which bends like lead (Gray says it is brittle!), the different layers separating at the end. I cut a good-sized switch, which was singularly tough and flexible, just like a cowhide, and would answer the purpose of one admirably. The color of the bark is a very pale brown. I was much interested in this shrub, since it was the Indian's rope. Frost said that the farmers of Vermont used it to tie up their fences with.

The great tensile strength of the bark of leatherwood has been noted by nearly all botanical writers—before and after Thoreau—who have discussed the plant. None, however, have presented quite so memorable a description as the late Edgar Anderson, former dendrologist of the Arnold Arboretum and long-time botanist at the Missouri Botanical Garden:

> Delicate though the flowers may be, the species is well deserving of its popular name as anyone will find who attempts to gather the flowering twigs without a sharp knife. The branches are surprisingly limber and the bark is tough and strong. One can actually tie the twigs in bow knots. If one attempts to snap off a branch quickly, the wood itself may break and separate from the bark. It may even come away altogether, leaving the startled flower-gatherer with a perfectly bare twig in his hand and on the bush, dangling like an empty glove, the bark with its flowers and leaves still intact.

Horticulturally, *Dirca* is noteworthy for reasons other than its bark, not the least of which is that it produces bright yellow flowers

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The unusual growth habit of leatherwood. Photographed in full bloom on May 1, 1989, by Ràcz and Debreczy.

in early April, when most other plants are still dormant. Another point of interest is its tendency to develop a single stem. This habit, which is unusual for a shrub, gives the plant the appearance of a miniature tree and makes it extremely useful in rock gardens and perennial beds. Despite leatherwood's preference for moist, shady sites in the wild, it will tolerate full sun under cultivation. Interestingly, when grown in the open, the plant assumes a more compact habit of growth, and the foliage, which is light green in the shade, takes on a distinct yellowish cast.

Because propagation data on leatherwood were either nonexistent or imprecise, I undertook a seed-germination project in 1979. At that time there were two *Dirca* plants at the Arboretum, both collected in New Hampshire in 1961. In early June the mature fruits were falling off. They were green at that point, with a slight tinge of yellow. The fruit is a berry with a fleshy outer seed coat and a hard, black inner coat surrounding a single large embryo.

I followed my usual practice when processing seeds preparatory to sowing them: I put them in a plastic bag and set them on a head-

The delicate flowers of Dirca palustris. *Photo by Ràcz and Debreczy.*

house bench until the fleshy part of the fruit softened enough so that it could be easily washed off. This "fermentation" cleaning, as it is called, usually takes about one week and works wonders with fleshy fruits like those of *Malus, Cornus,* and *Sorbus.* While this technique is not generally recommended in the seed-germination literature, it has long been used successfully with many types of plants at the Arboretum.

After a week I removed the rotting *Dirca* fruits from the bag and washed them clean

with water. I then subjected the seeds to various tests: some I sowed immediately in the greenhouse, some I stratified (this involves packing the seeds in a moist medium and storing them in a refrigerator for three months), and some I treated with the plant hormone gibberellic acid (GA_3). To my disappointment, none of these treatments produced a single plant.

Trying again in 1980, I collected 1177 seeds and designed an experiment that I thought would cover all possible types of seed-dormancy mechanisms. I put all the fruits in a plastic bag for fermentation cleaning, except for 77 that I pulled out at the last minute to use as a control. These I sowed in a flat, which was then planted outdoors to simulate the conditions the seeds would have been subjected to had they been allowed to fall from the plant.

The remaining 1100 seeds were allowed to rot for several days, after which they were cleaned and then subjected to every possible seed-germination test I could think of: stratification in the refrigerator, as well as in the greenhouse, gibberellic-acid soaks, and scarification with a knife. Finally, I carefully excised over 400 embryos from their seed coats and gave them the same treatments.

To my amazement, of the 1100 seeds so carefully cleaned and treated, not a single seedling was produced, but of the 77 uncleaned ones planted outdoors, 47 seedlings germinated the following spring—a staggering 61 percent. Here I had brought to bear nearly 10 years of experience in botanical research, along with a barrage of hormones and climate-control devices, when success could be achieved only by doing nothing. Humility is the main thing that I learned from this experiment. . . .

Clearly some plants propagate themselves best when left to their own devices. With *Dirca palustris*, letting nature run its course is not only very easy, but also very effective.

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Numbers in parentheses refer to issues, those in ***boldface*** *to illustrations of the entries.*

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